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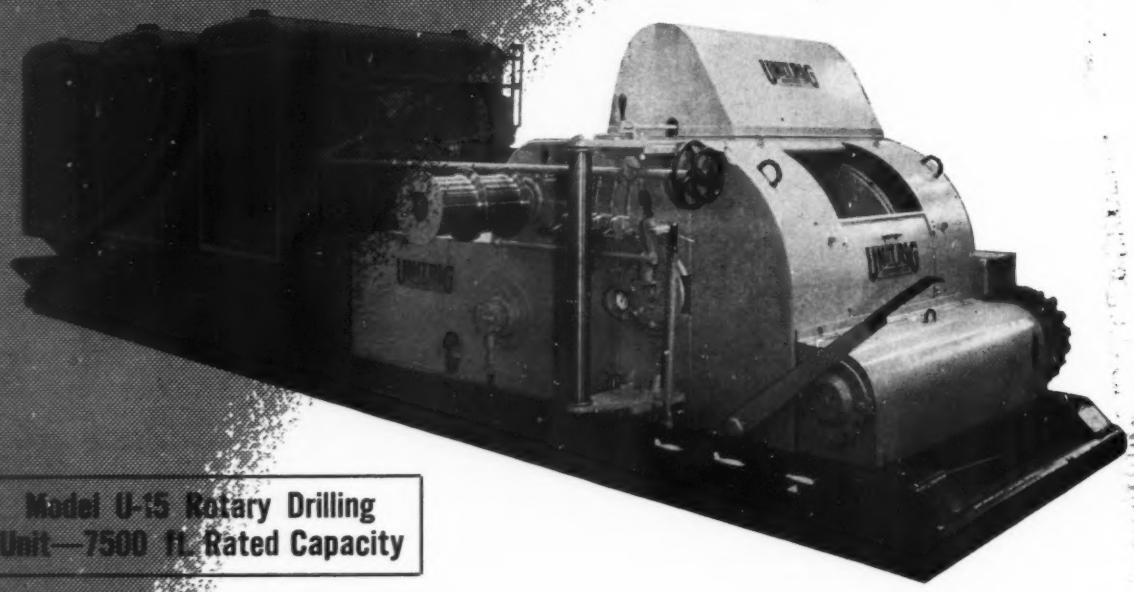

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THE OIL AND GAS JOURNAL

Where to Stop?

A FEW years ago students of merchandising were wondering where the sale of products at filling stations other than gasoline and lubricants should start. Now they are beginning to wonder where it should stop.

We were exposed to the much-discussed trend toward enlarged service-station facilities in postwar petroleum marketing through the purchase of a small can of machine oil for the family lawnmower. We reasoned that a petroleum lubricant used at millions of homes was a logical product to be sold at a station with expanded services. They were 'just out" of the oil at the first two of the superstations that we visited but a harassed attendant at the third, trying to do a half dozen things at the same time, finally found a can and the sale was consummated.

We were impressed with the range of merchandise offered at the three stations. At the first station across the aisle from where the oil cans should have been were shelves of books including dictionaries, bibles, and a fast-moving mystery novel. The same station had sports clothing, playground equipment, and toys. Another station had kitchenware and household appliances including an electric refrigerator. All three stations were selling radios and numerous other products not remotely connected with the marketing of petroleum products.

In what appears to be a confused retail marketing situation of direct importance to the entire petroleum industry several facts stand out. In the first place the expansion of services at retail stations to include most of the automobile accessories and services required by motorists is feasible under certain conditions. The competition of rubber companies and other operators of superstations starting in the early thirties created a competitive condition which oil companies and their dealers were forced to meet.

But there are limits to retail selling that can be successfully combined with the sale of motor fuels and lubricants. With shortages in practically all commodities the retailer has no difficulty now in disposing of anything he can buy. So it is impossible at this time to determine what can be sold permanently at a profit at service stations. Obviously there is no natural tie in with the sale of petroleum products and some of the merchandising operations now being undertaken. The economics of these relationships will become apparent when normal business conditions return.

Finally it is well to keep in mind that the entire petroleum industry is appraised by what takes place at the filling stations. Entering into competition at service stations with most of the merchants on Main Street could create a situation in which the oil business in its public and government relations would be judged by its marketing practices despite the fact that its principal business is to find, produce, transport, and refine petroleum.

FPC Approves Record-Size Texas California Pipe Line

by Dahl M. Duff

CONSTRUCTION of the $70,000,000 Texas-Los Angeles pipe line which is planned to deliver ultimately 305,000,000 cu. ft. of Texas natural gas daily to Southern California consumers, was authorized by the Federal Power Commission in a formal order last week.

The 1,200-mile, 24, 26, and 30-in. line—the first pipe line to span completely the Continental Divide and the largest ever built will be built by El Paso Natural Gas Co., El Paso, Tex., and two subsidiaries of Pacific Lighting Co., Southern California Gas Co. and Southern Counties Gas Co.

The opinion which accompanied the formal FPC order called attention to the general lack of opposition to the project, cited California's own declining gas production, and detailed the Texas sources which El Paso Natural will tap for the California deliveries.

The integrated pipe line system is planned for three progressive stages of construction and operation. Gas deliveries are scheduled to commence by June 1947, and continue for 30 years. Maximum contracted volumes to be delivered by El Paso are 125,000,000 cu. ft. daily the first year, 175,000,000 daily the second, third, and fourth years, and 305,000,000 cu. ft. daily, the fifth and succeeding years. The final stage of construction and operation is conditioned upon an election by the California companies prior to September 1, 1949.

Blythe Is Junction Point

El Paso Natural was authorized to build 737 miles of 26-in. line from Eunice, Lea County, New Mexico, to the California-Arizona state line near Blythe, Calif.; a 251-mile extension of 24-in. line from Dumas, Tex., to the Eunice plant, compressor stations with an aggregate in the final stage of 129,800 hp.; five connecting lateral lines in the Permian basin in New Mexico and Texas; and three gas purification and dehydration plants plus one gas dehydration plant. Total cost of these facilities is estimated at $53,800,000.

The two California companies were authorized to build during the first year 214 miles of 30-in. connecting line from near Blythe to Santa Fe Springs, Calif., a number of laterals, and other facilities. This line, the largest diameter line yet authorized by FPC, is designed for 52,000,000 cu. ft. daily of line-pack storage in addition to the rated delivery capacity of 305,000,000 cu. ft. daily. A 10,000-hp. compressor near Blythe is planned in the final stage of construction. Total cost of the California end is estimated at $16,225,000.

To meet the 30-year supply obligations, El Paso has executed contracts with Phillips Petroleum Co., for a 30-year supply from the Permian Basin and Panhandle and Hugoton fields for a possible maximum of 255,000,000 cu. ft. daily; Gulf Oil Corp. for a 20-year supply up to 30,000,000 cu. ft. daily from the Permian Basin; Shell Oil Co., Inc., for a 20-year supply from the Permian Basin at 20,000,000 cu. ft. daily; and Warren Petroleum Corp. for a 15-year supply of 10,000,000 cu. ft. daily from the Permian Basin. It is also negotiating for additional volumes now being vented in the Permian Basin along the route of the proposed line, the opinion said.

Although all three companies believe "it is essential to back-up the Permian Basin oil well gas with the dry gas reserves of the Panhandle-Hugoton area in order to finance the project," the opinion said, "an important consideration supporting the granting of this certificate is the strong showing by El Paso that it will probably utilize presently wasted Permian Basin oil-well gas for approximately 75 per cent of the maximum requirements . . . and take the remainder from the dry gas Panhandle and Hugoton fields."

Plans for Financing

According to the FPC record in the case, El Paso will finance its part of the construction by the sale of bonds amounting to $36,000,000 to six insurance companies, a bank loan of $8,500,000, and the sale of $11,500,000 in stock. The two California companies will finance their section from current funds supplemented by a bank loan of $10,000,000. FPC said rates for deliveries to the California companies will be 15 cents per 1,000 during the first year, 14½ cents during the next three years and 14 cents in the fifth and succeeding years under the 305,000,000 cu. ft. daily delivery stage.

Discussing the status of California gas production, the FPC opinion reviewed a number of facts which it said show the need for an out-of-state gas supply for the two California companies.

"The (California) companies own no natural gas production property and are dependent mainly upon oil-well gas instead of dry gas for their local source of supply," it said. As the oil producers are primarily interested in oil production, the gas companies must adapt their operations to the rate and volume of oil production to utilize the producers surplus oil-well gas. Lately the oil companies have undertaken major pressure maintenance and repressuring projects to increase future oil recoveries, thus withholding large volumes of gas from California utilities. Such gas may not be available to the California companies for from 15 to 25 years.

"According to the evidence, the volumes of oil-well gas available to the companies did not increase appreciably even during the war years when oil was produced in California in unprecedented quantities for military purposes. It is unlikely that future oil-well production in California will equal the large withdrawals from reserves, and the effect will be to reduce volumes of surplus gas available to gas companies."

In addition to this declining supply, the California companies are faced with steadily rising demand, the opinion added.

"The consumption per meter has been rising steadily over the years," it said, "and the population of the area served continues to grow. There is no competition from coal and little from fuel oil or electricity for space heating, cooking, and water heating."

Texas Electric Log Plan Encounters Opposition

DALLAS. — The Texas Railroad Commission's proposal requiring the use and publication of electric logs on all oil and gas wells completed in the state has met protests from some operators in West and North Central Texas.

A majority of operators, both independents and major companies, are reported to feel the high cost of drilling a wildcat entitles them to withhold any information gained by the drilling. Some of those not opposed to the electric log order itself were of the opinion that protection should be accorded the operator, such as by delayed filing of the log from 6 months to a year after completion of the well.

Hearing on the proposal is set for June 19 in Austin. Evidence to be presented at the hearing by West Texas operators was to be gathered at a meeting of the North Basin Pools Engineering Committee at Midland, June 14.

A.P.I. Session Hears Case Histories of Oil Recoveries

by Kenneth B. Barnes

OKLAHOMA CITY.—What pressure maintenance, cycling, gas repressuring, and water drives do in increasing recovery was decisively answered here on June 6 and 7. What can be done to speed rates of penetrations in drilling hard formations was told by drilling engineers in terms of accomplished facts. The makeup and performance of an entirely new type of drilling mud was brought to light for the first time.

These subjects, basically falling into the industry's twin aims of increasing yields and decreasing costs, are in the forefront of present studies and efforts in drilling and production activities, and the large group of 420 representatives from Kansas, Oklahoma, and the Texas Panhandle paid close attention to the covering reports and papers presented at the spring meeting of the Mid-Continent district of American Petroleum Institute. One might expect that disclosure of many engineering developments and new advances, piled up during the push for oil and gas during the war, might now soon be made—and that is exactly what happened at the sessions held at Skirvin Tower Hotel. Many said that more factual information and definitive figures on new practices were given there than at any previous similar meeting they had attended. In the audience additionally, were a number of technical men from Houston, Dallas, Fort Worth, and other places in Texas, Louisiana, California, and even from eastern spots.

W. T. Payne, in his address of welcome, expressed the above themes in this way: "In the past, an early A.P.I. undertaking, and one that has been maintained, has been to bring about the adoption of uniform standards of equipment. This has not only saved the industry large sums of money, but has led to the acceptance of A.P.I. equipment specifications as standard throughout the world . . . Now, however, increased recognition and importance is being given to the obligation of spreading, as widely as possible through the industry, the principles and practices of efficient reservoir operation and oil-pool management. I am gratified to see the majority of papers to be presented are along this line . . . to the problems of maximum efficiency in the extraction of oil and gas from the underground accumulations. This effort will be in addition to further work on those mechanical problems of ours in drilling, well completion, and production that must be further improved and the costs lessened." He pointed out that hundreds of A.P.I. committees have conducted studies and presented useful papers, reports, and knowledge to the industry, but that these Mid-Continent and other district A.P.I. meetings hitherto have had to be shortened and deferred by the war.

This is the "over-all picture" of the Mid-Continent district A.P.I. meeting. Abstracts of the presentations start on page 120 of this issue; and "Electric Pumping of Wells" appears on page 125. The papers on "International Outlook" and "Rotary Penetration Rates" were printed in the June 8 Journal.

Payne paid tribute to the organization by saying, "The letters A.P.I. have long stood for progress in the oil industry. The Institute was established in the spirit of national service which has been its guiding principle ever since. The purposes announced in the original bylaws were 'to afford a means of cooperation with the Government in all matters of national concern' and 'to promote the study of the arts and sciences connected with the petroleum industry.' Its founders sought to establish a body that would promote the efficiency of the industry, increase its ability to serve the public and give strength to the nation wherever such support was needed."

Payne is chairman of the oil and gas division of the Oklahoma City Chamber of Commerce and president of Big Chief Drilling Co.

Reservoir Operations Are Featured

There were 10 papers presented which dealt with the case histories of various types of reservoir-injection programs and their operating results, and on the factors and problems involved in modern unitization agreements. Each of the papers was a complete treatise in itself, but the collective pattern for the presentation of the subject was due to planned efforts of the production technology and secondary recovery committees of the Mid-Continent district organization. The committees, headed by W. L. Horner, Barnsdall Oil Co., Tulsa, have been engaged in studies of bypassing and channeling in reservoir-injection work, along with studies of reservoir-control mechanics, different recovery processes, and the prediction of future reservoir performance. This particular section of the general program, therefore, was designed so as to present further factual data complementary to these efforts. The committees previously had held a combined session on June 5 at the meeting and formulated a continuing program on

New officers of Mid-Continent district, production division, A.P.I., elected at Oklahoma City, June 7. Standing: J. N. Perkins, Phillips Petroleum Co., Borger, Tex., vice chairman for Texas Panhandle and J. R. Evans, Stanolind Oil & Gas Co., Tulsa, vice chairman for Oklahoma. Seated: Harold S. Kelly, Phillips Petroleum Co., Bartlesville, chairman. Not present: H. K. Zoller, Derby Oil Co., Wichita, vice chairman for Kansas, and C. M. Copeland, Williams - Copeland Drilling Co., Tulsa, secretary-treasurer

these matters, but with increased scope.

The special-study committee on allocation of production and well spacing, with H. H. Kaveler as chairman, also met at the same time and reviewed their studies and future plans, as did the subcommittee on core analysis and well logging, with R. B. McCloy, Stanolind Oil & Gas Co., Tulsa, chairman; the committee on production practices, with H. S. Kelly, chairman; the committee on materials, R. P. Moscrip, chairman; and the drilling-practice committee, with W. W. Moore, chairman.

Drilling Papers Present New Ideas

The use of long drill collars—up to as much as 600 ft.—and other factors which have been found to aid in speeding drilling in hard formations, were described by J. W. Warren and R. B. Schabarum (complete paper published in The Oil and Gas Journal of June 8, pp. 82-87). The features imparted to drilling muds by a new chemical, sodium carboxymethyl-cellulose, as first outlined by C. R. Wagoner and then developed and field tested by the production-research and drilling-tool divisions of Phillips Petroleum Co., was detailed by Kaveler.

W. L. Horner, Barnsdall Oil Co., Tulsa, chairman of the A.P.I. committees on production technology and secondary recovery, which had a prominent part in the program at Oklahoma City

This chemical is a water-soluble cellulose derivative. In actual performance in wells in the Hugoton field of western Kansas and in the South Tyler field of East Texas very substantial savings were obtained. Use of this colloidal material in drilling mud, it was predicted, would help cut the cost of well drilling, particularly in areas where anhydrite, salt, or heaving shale must be penetrated. While the source of supply of the water-soluble cellulose is limited at present, it was stated that steps are now under way to develop quantity production in order to make the new-type drilling-mud additive available to the industry by 1947, perhaps sooner. While the present market price of the chemical is said to be about 70 cents per pound, the figures given in the paper showed that only relatively small quantities usually were needed.

McCloy explained the different kinds of equipment used in drilling and coring to develop secondary-recovery operations and compared the factors where different methods and types of equipment were used.

Merits of pumping wells with electric power were explained by J. H. Field, Sohio Petroleum Co., Oklahoma City, together with methods of calculating horsepower requirements and presentation of electric cost facts (the paper is given on page 125 of this issue of the Journal).

"International Petroleum Outlook in Relation to Operations in the United States" was explained by C. O. Willson, editor of The Oil and Gas Journal (this article was published in the June 8 issue of the Journal, pp. 65-69). Background for the figures and trends presented on worldwide petroleum operations was obtained by Willson during recent trips through the Middle East and South American areas.

Unitization Needs Support From Industry

R. M. Williams, Bartlesville, unitization expert in the legal department of Phillips Petroleum Co., said that problems of unitization lay directly with the oil industry itself and, basically, there were very few obstructions to unitization efforts that could be laid to the legal side. Plenty of court decisions, coupled with favorable statutes and attitudes of state commissions, were cited by Williams as being decidedly helpful in getting unit operations on a legally recognizable basis. The lawyers and recalcitrant royalty owners have been used as "whipping boys" whenever authorization efforts have failed, Williams explained, but actually, the basic trouble in such cases has been that the engineers working on the ventures have not been backed up and encouraged by their principals or managements soon enough. It was said that more such support, accompanied by an industry-wide educational program and clearcut explanations to smaller working interests and royalty owners, would greatly speed up the successful promulgation of many unit plans which might otherwise long drag out and perhaps fail in final conclusion.

L. L. Gray, of Gulf Oil Corp., Tulsa, discussed from a practical side the "do's and don'ts" involved in setting up pressure-maintenance and unitization projects.

The pressure-maintenance, cycling, gas-repressuring and water-drive papers on the program were given by L. L. McWilliams, A. W. Baucum and W. D. Steinle; M. B. Penn, W. C. Imbt and S. P. Allison, Jr.; M. G. Miller and M. R. Lentz; L. E. Elkins, C. C. Rae and T. F. Lawry.

Porter, Hardey Call for Oil Industry Decontrol

Two more attacks against continuation of price controls on petroleum and its products were made last week by oil industry leaders.

In Tulsa, F. M. Porter, president of the Mid-Continent Oil and Gas Association, called on citizens of the oil producing states to urge their senators to support an amendment to the price extension bill which will remove crude and products from control.

"Unless the control extension bill is amended on the floor of the Senate this coming week in a manner that will assure decontrol of petroleum and its products, the oil industry will continue to suffer from wholly inadequate prices and particularly from the eternal confusion that is generated by the controls exercised by the Office of Price Administration," Porter said. "The entire economy of the oil-producing states will be further and seriously impaired."

Claims of OPA officials, including Paul Porter, head of the agency, that oil decontrol is not justified at this time were challenged by B. A. Hardey, Shreveport, president of the Independent Petroleum Association of America.

Hardey accused the OPA of quibbling and hair-splitting and said independent producers never had a chance to present the facts to OPA. His statement was made after Porter notified D. H. Byrd, Dallas, that petroleum and products do not meet any of the standards under which OPA orders decontrol. Porter said he took full official responsibility for not recommending decontrol at this time.

Crude Imports in April Show Gain Over March

WASHINGTON.—Crude petroleum and products imported into the United States averaged 338,800 bbl. daily during April, according to data prepared by the Bureau of Census. Imports of crude oil for the year increased sharply in comparison with last year, while refined products were slightly behind last year.

While the April imports of crude and refined products was 10,165,000 bbl., up 2.3 per cent over March's total of 9,932,000 bbl., the cumulative total figure from January through April was 43,928,000 bbl., against 33,550,000 bbl. for the corresponding period last year, an increase of 30.9 per cent.

April imports of crude oil alone were 7,867,000 bbl., up 19.6 per cent over March's 6,578,000 bbl. Refined products imported in April dropped 31.5 per cent, for a total of 2,298,000 bbl., against 3,354,000 bbl. in March. The daily average of 76,600 bbl. of petroleum products imported in April consisted of 62,800 bbl. of residual fuel oil, and the balance in distillate, asphalt and unfinished oils.

Venezuela again was the largest single supplier of crude oil and products during April, with a total of 6,714,000 bbl. for the month. Others exporting to this country in April were Netherlands West Indies, 2,024,000 bbl.; Colombia, 926,000 bbl.; and Mexico, 501,000 bbl.

THIS WEEK

PRODUCTION—United States crude production hits new all-time peak. . . . Output in week ended June 8 estimated at 4,936,370 bbl. daily—2,770 bbl. daily over previous high figured on same basis last August. . . . ¶Crude stocks drop 3,329,000 bbl. during week ended June 1. . . . Seasonal stock trends shown in figures for June 1 week. . . . gasoline inventories drop. . . . residual and distillate fuel-oil stocks gain. . . .

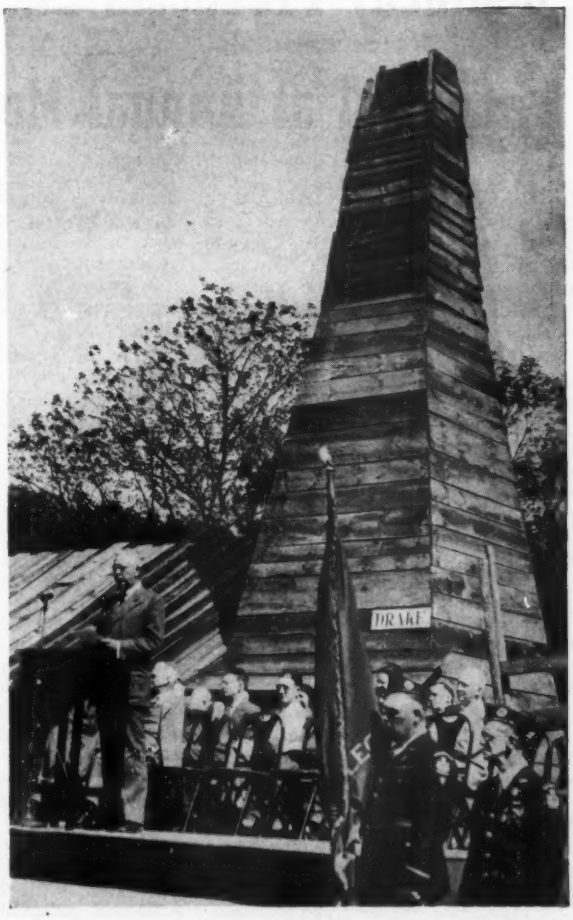
NATURAL GAS—Gas line from Texas Panhandle to Los Angeles area approved by FPC. . . . First deliveries set for June 1947. . . . Line includes 30-in. section in California, largest ever laid. . . . FPC opinion points out California's declining gas supply and commends proposed use of wasted oil-well gas in Permian Basin. . . . ¶Natural-gas industry, coal and railroad interests fighting gas expansion, prepare for opening June 17 of FPC's final hearing in prolonged gas investigation. . . . Hearing expected to last well into July. . . . ¶FPC authorizes Northern Natural Gas Co.'s $7,886,076 program to extend service in Nebraska, Iowa, and Minnesota. . . .

PRICES—Oil industry leaders renew fight on OPA controls. . . . F. M. Porter, Mid-Continent Oil and Gas Association head, asks public support for decontrol amendment to prevent disruption of economy of producing states. . . . Hardey again attacks OPA. . . . Asserts campaign under way to divert public attention from "debauchery of American principles and corruption of morals which OPA has created." . . . ¶Fight continues in Congress over OPA extension. . . . Some observers believe president will veto measure and force Congress to pass last-minute resolution extending present law. . . . ¶Gasoline prices continue upward march. . . . Now back at near-ceiling levels. . . . Indiana Standard boosts tank-wagon prices 3/10 cent in 11-state Midwest area. . . .

TRANSPORTATION—Unions say tanker operations will be exempted from any general strike. . . . Statement reflects favorably on working conditions on oil company vessels. . . . Washington officials express hope walkout will be averted. . . . ¶WAA sets July 30 as close-out date for bids on big inch lines. . . . Move considered effort to force all definite offers into the open. . . .

INTERNATIONAL—Second test on Chile's southern tip reported down to 8,500 ft. . . . Depth is 1,000 ft. below level at which production was found in first wildcat. . . . Kuwait crude shipments scheduled to begin early in July. . . . Construction starts on new refinery at Sydney, Australia. . . . Plant will use crude from Persian Gulf and produce 350,000 bbl. asphalt annually as well as other products. . . . Caltex holds 40 per cent interest in project. . . .

REGULATION—Initial meeting of industry advisory committee to new Oil and Gas Division not likely before July. . . . Davies feels first meeting should be delayed until Krug's return from his western trip. . . . ¶More reports heard that Justice Department is ready to accept consent decree in antitrust case against A.P.I. . . . Oil company defendants expected to ask 30-day extension of June 20 hearing date to continue negotiations for out-of-court settlement. . . . ¶Opposition develops to proposal to require electric logs on all Texas completions. . . . Texas Railroad Commission to study plan in hearing June 19. . . .



An exact replica of the Drake well was dedicated in ceremonies last week at Drake Memorial Park, Titusville, Pa., celebrating the eighty-seventh anniversary of the first commercial oil well drilled on the banks of Oil Creek by E. L. Drake. Pennsylvania's Governor Edward Martin, the principal speaker, gave a resume of events leading up to completion of the well on August 27, 1859, and of the progress of the oil industry since that time. In building the replica, every effort was made to reproduce faithfully the original derrick and shed which were destroyed by fire shortly after completion of the well. From photographs, the use of unseasoned white pine lumber, and reports of the materials in the original structure, the reproduction was erected on the site of the original well

A group of oil industry officials is shown here in attendance at the annual midyear session of the Kentucky Oil and Gas Association at Lexington last week. Seated are P. C. VanGilst, vice president of the Kentucky association; B. A. Hardey, Shreveport, La., president of the Independent Petroleum Association of America; and M. A. Arvin, president of the Kentucky association. Standing are E. L. McDonald, Lexington, secretary, and J. C. Preston, Owensboro, executive secretary-treasurer of the Kentucky association; H. M. McClure, Alma, Mich., president of the National Stripper Well Association; M. G. Powers, Huntington, W. Va.; and Karl Z. Wilking, Owensboro, both vice presidents of the Kentucky association

Kentucky Producers Blast Price Control at Annual Meeting

LEXINGTON, Ky.—Federal price controls should be removed from the oil industry, the price of crude oil should be increased, Kentucky producers must prepare for competition from the four corners of the world, and adequate conservation laws should be enacted in all petroleum-producing states if the interests of the oil industry are to be served.

Such were the major conclusions of members of the Kentucky Oil and Gas Association at their annual midyear convention here June 7 and 8.

Forthright criticism of price control was expressed by J. Howard Marshall, president of Ashland Oil & Refining Co. and by B. A. Hardey, president of the Independent Petroleum Association of America, who were among the speakers at the 2-day meeting.

Marshall, speaking informally, on the subject of "Kentucky Oil: Its Future," warned that the small and independent producers are being "squeezed to death" by wage and hour regulations and by price controls and were being threatened with "loaded dice" competition from the far-off fields of Iran, Arabia, Venezuela—"only 40 cents a barrel from New York."

"A revolution has occurred in transportation," said the Ashland official in commenting on tanker shipments and cross-country pipe lines. "We cannot survive this type of competition in the face of price controls and increasing costs and outside regulations."

"Our oil is worth what we can get for it," he said.

But, even with the OPA shackles removed, the industry still will be faced with other problems—competition not only from foreign fields but from synthetic sources for substitute products, he added.

"I don't want to paint a discouraging picture," Marshall concluded. "As an industry we have enough energy and enough vitality to face our problems and to solve them so that the oil industry in Kentucky won't be left at the post."

A similar attack on continued federal control was launched by Hardey, who made the principal address at the banquet Saturday.

Hardey declared that there no longer was any need for continued restrictions now that the war was over, and that the petroleum industry was able to take care of itself and should be allowed to look ahead on a normal competitive basis.

A challenge to members of the oil industry to "start being men and quit being monkeys" was made by H. M. McClure of Alma, Mich., president of the National Stripper Well Association.

In an informal address, McClure charged that oil which cost 4 cents to find, develop, and produce, was being sold at 3 cents a gallon. He suggested that "we do whatever is necessary to bring the price up." If it costs 4 cents a gallon to produce the oil, he reasoned, then a price of 5 cents a gallon—a 1-cent profit—certainly is a fair and reasonable price.

"The oil industry won't have to bow its head in shame," McClure promised, "if the price of petroleum products go up 1 or 2 cents a gallon to cover the very necessary increase in the price of crude petroleum."

Approve Stripper Payments

The Kentucky association approved unanimously a resolution endorsing the permanent plan of oil conservation payments for stripper wells which was adopted May 21 by the Stripper Well Association.

The convention opened informally Friday afternoon with a golf tournament, followed by a joint session of directors of the I.P.A.A. and the Kentucky group. At an election Friday night all officers were reelected for the next 2 years, as follows:

M. A. Arvin, Owensboro, president; P. C. VanGilst, Ashland, vice president; M. G. Powers, Huntington, W. Va., vice president; Karl Z. Wilking, Owensboro, vice president; E. L. McDonald, Lexington, secretary; and J. C. Preston, Owensboro, executive secretary-treasurer.

More than 200 delegates had registered for the convention early Saturday morning, and many were present at the technical session, at which Daniel J. Jones, state geologist, read a paper on "Natural Gas Reserves of Kentucky" and J. L. Rogers, of Carter Oil Co., presented a paper on "Casing Cementing Practices in the Eastern Interior Coal Basin."

Rogers, who is stationed at Carmi, Ill., presented a number of important engineering details in his paper. Pointing out that the relatively short time-interval while running and cementing casing is one of the most critical periods in the entire life of an oil or gas well, Rogers first discussed the history of multiple sand completion methods in Illinois, Indiana, and Kentucky.

Growth of placing alloy windows in the casing strings was shown by the fact that there were only 4.9 per cent such completions in 1939, but for the year 1945 this type accounted for 16.8 per cent of all oil well completions in the area. Multiple-sand cementing, another practice which has grown in that territory, was listed for one op-

(Continued on page 169)

Crude Production at New High, With Texas Furnishing Peak

by Charles J. Deegan

CRUDE oil production in the United States established a new all-time high record last week at 4,936,370 bbl. daily, surpassing the wartime peak in the week of August 11, 1945, by 2,770 bbl. daily. The actual crude reported last week, 4,910,170 bbl., excluded 26,200 bbl. of condensate that until a few weeks ago had been reported as crude. Since the wartime peak also included this condensate as crude, the 26,200 bbl. must be added into the crude reported last week, to make a comparison.

The State of Texas was responsible for the new peak, with an increase of nearly 150,000 bbl. over the previous week, representing the response to the new high June allowables fixed by the Railroad Commission in response to the insistent nominations of the crude purchasers and refiners.

Breakdown of the comparison of the new peak with the wartime peak shows Texas up 56,500 bbl. daily, Louisiana up 22,850 bbl. daily, and California down 75,800 bbl. daily. These are the three leading states, and their net balance shows an increase of 3,550 bbl. over the wartime peak, leaving all other producing states combined about 800 bbl. daily below the wartime top.

Including the production of condensate, natural gasoline, and allied light hydrocarbons from the cycling and gasoline plants, of something over 300,000 bbl. daily, the industry is now producing nearly 5¼ million barrels daily of raw and semifinished material.

The current production rate is 266,000 bbl. daily higher than the Bureau of Mines estimate of crude demand in June, and it remains to be seen whether the demand figures are going to be revised upward, or the production allowables curtailed, if stocks of crude build up rapidly. Currently the weekly crude stocks reported are slightly below the comparable figures of last year. However, about this time last year, during the war, crude stocks began a slump that took them to critically low levels in August. Gasoline stocks are roughly 10 per cent higher than at this time last year, but have been on a normal seasonal decline for several weeks. Residual and distillate stocks are slightly above their critically low levels of this time last year, and are seasonally on the increase, but to date at only a normal rate.

Weekly crude-run reports by refiners are 234,000 bbl. daily below those of the week previous to the crude production record of last August, with about two-thirds of this decrease accounted for by California. If crude stocks do not build up rapidly, and reported runs fail to increase, the increased production will probably be going into the export market. The next few weeks should tell whether the market can absorb this increased production without an abnormal crude-stock buildup.

Krug's Speeches Expose Philosophy

WASHINGTON. — Secretary of the Interior Julius A. Krug has given an insight into his beliefs regarding conservation of natural resources by statements made on his current trip through western states.

So far he has talked much about metals and timber, but his attitude toward all resources is consistent, and he has stressed conservation frequently. In one speech he said, "The Department of the Interior, and I as secretary of the interior, have a deep concern that in the management of the department's affairs, which touch at so many points on the utilization of our natural resources, all resources shall be wisely used. That is the essence of conservation."

In another speech he expanded this thought as follows: "Conservation in terms of the national interest means the intelligent use of our resources with a due regard for the future. It does not mean skimping ourselves today so as to have abundance a hundred years from now. But it does mean knowing accurately as possible how we stand and making our plans accordingly. Conservation means careful mining to avoid the irretrievable loss of valuable minerals. It means the development of new technology that will in the future open up low-grade deposits which are now commercially out of reach. Conservation means economy in the use of materials. It means finding substitutes for scarce materials, and preventing their frivolous use in forms that add nothing worthwhile to the standard of living. In substance, conservation is prudent engineering practice and good management of the national estate, a duty and privilege of all Americans, and especially of those of us who deal with technology."

The secretary reiterated his view that an inventory of all our natural resources is one of the first problems facing the department so that it may become the basis of national policy. In the meantime, he made this comment on the subject:

"The practical attitude is to base our national policies on what we know, with a degree of assurance in proportion to how sure we are of our knowledge. We are sure of proved and measured reserves, fairly sure of indicated reserves, and reasonably confident of inferred reserves. These terms apply to deposits of commercial grade under present conditions of technology and price. Marginal reserves that can be worked at higher prices may be taken into account, for whatever they seem to be worth. For instance, coal as a source of motor fuel is a large ultimate reserve, but at a cost, under present conditions, of two or three times the cost of gasoline at the refinery. How soon we will get to it will depend on our ability to import petroleum, and that is a major problem of national policy."

Egloff Describes Oil's 'Aids' to Agriculture

OKLAHOMA CITY. — Progress made in development of by-products of the petroleum industry to the benefit of agriculture, was outlined in an address before the Second Southwest Chemurgic Clinic, National Farm Chemurgic Council, by Dr. Gustav Egloff, Universal Oil Products Co.

Among the products are the insect repellents, fertilizers, preservatives, and products to speed growth and increase yield of fruits and vegetables. "New in agricultural use," he said, "is ethylene gas, which when sprayed on seed potatoes, results in a 20 to 100 per cent increase in yield." Petroleum greases, used in smearing the hides, have added to the weight of livestock by eliminating the irritation caused by insect pests.

Cosgrove Named Chairman Of Continental Directors

PONCA CITY, Okla.—James J. Cosgrove, vice president and general counsel of Continental Oil Co., was elected chairman of the board of directors of the company at a special meeting of the board held in New York this week. The by-laws of the company were amended to give the chairman executive powers. Cosgrove has been with Continental Oil Co. since 1929.

International

WORLD-WIDE OIL DEVELOPMENTS

Venezuelan Output Still Exceeding 1945 Figures

CARACAS.—According to figures released by the Venezuelan Government, the rate of petroleum production for 1946 continues to increase over the 1945 figures. The United States is receiving the bulk of the oil with European and other markets following a poor second and third in importance.

According to local executives, the demand for Venezuelan crude is expected to remain at the present high level for the rest of the present year, with the limiting factor of production being based on the ability of the operating companies to physically produce more oil. In order to meet the anticipated demand, the companies are intensively developing proved acreage, and at the same time pursuing an extensive wildcatting program in order to open new production.

Largest Producers

At the present time, Creole Petroleum Corp. (Standard); Venezuelan Oil Concessions, Caribbean Petroleum Co., Colon Development (all in the Shell group); and the Mene Grande Oil Co. (Gulf) are producing the largest portion of the oil, with Compañia Consolidada de Petroleo (Sinclair) and Socony-Vacuum Oil Co. following. Several of the newer and some of the smaller companies are contributing a small but increasing amount.

VENEZUELAN PRODUCTION BY COMPANIES

(Figures in barrels)

Company—	First quarter 1946	1945
Creole Petroleum Corp.	49,020,602	176,329,496
Venezuelan Oil Concessions, Ltd.	17,709,915	61,725,833
Mene Grande Oil Co.	13,866,570	49,774,078
Caribbean Pet. Co.	3,832,166	13,973,125
Compania Consolidada de Petroleo	2,768,354	10,449,696
Colon Development Co.	1,626,408	5,807,295
Socony-Vacuum Oil Co.	1,398,849	4,087,736
Texas Petroleum Co.	209,995	678,700
British Controlled Oilfields, Ltd.	94,650	417,877
Orinoco Oil Co.	25,646	146,052
Venezuelan Atlantic Refining Co.	7,781	34,465
Soc. Anma. Petrolera Las Mercedes	13,272	15,852
Total	90,574,217	323,440,205
Daily average	1,006,379	886,138

VENEZUELA PRODUCTION BY FIELDS

(Figures in barrels)

Field—	First quarter 1946	1945
Lagunillas	27,392,353	97,097,226
Tia Juana	15,244,731	48,899,252
Cabimas	5,631,217	25,679,651
Guara	6,036,370	18,335,027
Jusepin	4,776,647	17,947,098
Oficina	3,166,266	15,261,444
Quiriquire	4,573,552	14,458,758
Santa Barbara	4,042,382	13,797,230
Bachaquero	3,548,672	13,597,871
Mene Grande	3,281,690	12,832,531
Mulata	2,614,331	10,831,341
La Paz	2,598,190	8,093,778
El Cubo	1,626,408	5,807,295
San Joaquin	925,697	4,036,211
Guico	1,037,548	2,378,299
Temblador	564,956	2,102,561
Cumarebo	443,970	1,885,155
El Roble	382,380	1,742,839
Guario	361,301	1,709,437
Pueblo Viejo	605,479	1,608,304
La Concepcion	260,407	1,355,256
Mara	550,475	1,140,593
Leona	427,382	733,132
Rincon Largo	203,346	657,288
Santa Rosa	101,736	548,191
Hombre Pintado	56,652	242,253
El Mene de Mauroa	38,007	175,624
Santa Ana	.....	163,936
Netick	25,646	146,052
Quiamare	18,997	93,608
Pirital	7,781	34,465
Las Mercedes	13,272	15,852
Tucupita	6,649	15,078
Capacho	.....	7,032
Los Caritos	.....	6,334
Nipa	9,655	4,189
Total	90,574,145	323,440,191

The Texas Co. and its affiliate the S.A. Petrolera Las Mercedes Co. have made available a potentially large source of production in their Guarico holdings and in their newly discovered field in the Delta Amacuro. These proved areas are not now being produced because of lack of facilities for moving the oil. However, should a pipe line outlet be provided for the Guarico production and shipping arrangements be made available for the Delta during the current year a substantial amount of crude will be added to Venezuelan production.

Production figures for the first quarter of 1946 together with total production for 1945 by companies is shown in the accompanying tables.

Construction Under Way On Sydney Refinery

NEW YORK.—Construction of the Bitumen & Oil Refineries, Australia, Ltd., refinery at Sydney got underway early this month, according to officials of the California Texas Oil Co., Ltd., which holds a 40 per cent interest, the remaining 60 per cent being held by Australian public subscription. Bitumen was formed in March of this year with a capital of $6,500,000.

Officials of Caltex, the jointly-owned subsidiary of Standard Oil Co. of California and The Texas Co., also stated that the new refinery, which will utilize as much local building material as possible, is being designed to turn out 50,000 tons (350,000 bbl.) yearly of asphalt, as well as gasoline and other petroleum products.

Crude from the Persian Gulf will be used as the charging stock. Previously it was thought that the crude would come from the United States. Arabian American Oil Co., another subsidiary of California Standard and Texaco, operates in Arabia, and Bahrein Petroleum Co., Ltd., also a joint subsidiary, on Bahrein Island.

David Craig, board chairman, and A. J. Wilcox, secretary, are both Australians. In the next few months, 20 Australians will be selected for training in the United States and eventually will be part of the refinery's key personnel.

Permanent Anchorages

Permanent anchorages for tankers in Botany Bay and construction of a submarine pipe line, to receiving tanks at the refinery, constitute part of the program. Bitumen will be shipped in tank cars equipped with heating coils. Completion of the plant is expected by June 1947.

Arthur G. McKee, Cleveland, has the engineering contract. W. G. Miller, Caltex construction superintendent, is handling the actual building and is employing Australian labor.

Meanwhile, the Australian minister of supply and shipping has announced that a search for oil is slated in the Kimberley area of western Australia under a cooperative ar-

rangement between the Commonwealth and state governments. Later, it is hoped to extend this search to all Australian territories. Australia has no commercial production.

H. Temple Watts, petroleum technologist, is reported to be head of an exploratory party, with plans underway for the purchase of the latest type equipment. A permanent mining council is to be created and reportedly will be the instrument through which the oil industry will be placed on some type of a national basis, but which, presumably, will permit foreign capital to participate.

Second Tierra del Fuego Well Down to 8,500 Ft.

NEW YORK.—Chile's second well, located in the remote Tierra del Fuego Archipelago, is down to 8,500 ft., an official of Corporacion de Fomento de la Produccion said here last week. It was hoped that oil would be found at the 7,500-ft. level where the discovery well was brought in last December as an 8,000-bbl. daily producer. The well, which produced 39° A.P.I. gravity crude was shut in due to lack of adequate transportation.

This second well is located 800 meters (about ½ mile) northeast of the discovery well. A third well is planned upon completion of the second. George P. Livermore Corp., of Texas, is the drilling contractor.

Meanwhile, a report from Santiago states that "several European countries" have offered financial assistance to the Chilean Government in the exploitation of the country's oil. The Chilean minister of national economy made this statement. As Chilean law provides that only the Government may engage in the exploration and exploitation of oil, it was explained here in New York, by a Fomento official, that the financial assistance would have to be in form of a loan direct to the Government, with no joint foreign capital - Government participation.

British Zone of Germany Producing 12,900 Bbl. Daily

LONDON. — Germany's current crude production in the British zone of occupation, is currently estimated to be around 12,900 bbl. daily, a figure nearly equal to the combined output from fields throughout Germany.

When the Allies first took over a little more than a year ago, daily production, in what is now the British zone, was slightly over 3,920 bbl. Credit for the relatively sharp rise is given to the assistance accorded by the military government and the British Control Commission. The commission's general policy is to insure maximum production from Germany's oil and gas fields. In the British zone, oil and gas activities are carried on by the North German Oil Control Commission.

The 24 oil fields and 1 gas field, in the British zone, are located near the Dutch border around Celle and Hamburg. While most of the wells are on pump, some wells in the Wesendorf field flow through ⅛-in. chokes at the rate of 240 bbl. daily.

About 10,000,000 cu. ft. of gas is produced daily from the limestone rock of the field near Bentheim on the Dutch border. As yet no oil has been discovered there. The gas is piped to Huls, in the Ruhr, via an 8-in. line. Most of it is used in a synthetic-rubber plant.

Before the war, Germany's estimated crude reserves were placed at 85,000,000 bbl. and a daily production of 20,000 bbl. The estimated number of refineries totaled 42 with a daily refining capacity of 70,000 bbl.

Iraq Development and Exploration Under Way

WASHINGTON.—Petroleum development, exploration, and pipe line construction in Iraq, almost completely halted during the war, are again under way, according to reports reaching the U. S. Bureau of Mines here.

Plans for two additional 16-in. pipe lines paralleling the two existing 12-in. lines of the Iraq Petroleum Co. were completed in 1945. Preliminary work has been initiated on one of the new 16-in. lines, including the stringing of pipe, between Haifa in Palestine and Kirkuk in Iraq, a distance of 620 miles. Considerable quantities of material are said to have arrived during the last quarter of 1945. Work on a second line from Kirkuk to Tripoli, Lebanon, a distance of 545 miles, has not begun.

Oil exploration work, stopped at the outbreak of the war, is reported to have been resumed near Jebel Sinan, south of Basra. Mosul Petroleum Co., formerly known as the British Oil Development Co. and the Basra Petroleum Co. have geophysical parties in that area.

Indication of Oil Found by Danish-American Company

COPENHAGEN, Denmark. — Danish-American Prospecting Co. is expected to vigorously resist efforts to cancel its exploration agreement with the Danish Government in view of the discovery of an oil indication in north Jutland.

The company has succeeded in tracing salt at 870 ft. Before the war, the company held exclusive rights to exploit for oil in the country, but recently official Danish circles have discussed the possibility of canceling the agreement.

S. A. Andersen, director of the Danish Geological Society, last week urged the Government to prohibit all foreign oil drilling. The concession held by Danish-American Prospecting, a branch of Gulf Oil Corp., was granted in 1936 and is effective until 1988.

Iraq Preparing to Invite Bids for Baiji Refinery

WASHINGTON.—The Iraq Government has made public its intention of reviving a prewar project to erect and operate an oil refinery at Baiji, south of Mosul, according to the U. S. Bureau of Mines. Foster Wheeler Ltd., of England, was to be the consulting engineering company and in 1939 had submitted a design of the proposed refinery.

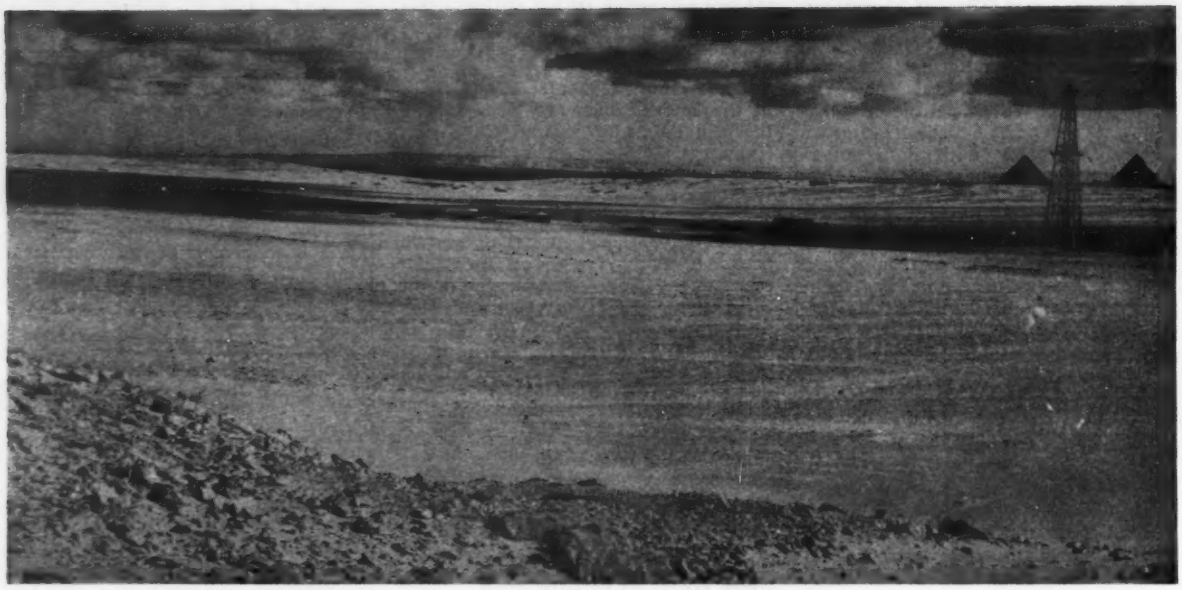
The Iraq Ministry of Economics has now requested the engineering firm to revise original plans, with a view of inviting bids by refinery construction companies. The proposed Baiji plant would presumably supersede the Khanaqin Oil Co. (a subsidiary of Anglo-Iranian Oil Co.) as supplier of refined petroleum products for the northern and central districts of Iraq. Abadan Oil Refinery, also a subsidiary of Anglo-Iranian, supplies the southern portion of Iraq. Both Khanaqin and Abadan market their products in Iraq under the terms of a concession which will expire in 1996.

The Iraq Government claims that it is entitled to obtain crude oil from the Iraq Petroleum Co. and to operate its own refinery. Thus far the Anglo-Iranian Oil Co. has failed to make public its policy with regard to the enforcement of the concession granted to it by the Iraq Government.

Kuwait Shipment Due To Start in July

NEW YORK.—Shipments of Kuwait's (Persian Gulf) crude is definitely slated to get under way early in July, according to official sources here last week who stated that the shipments originally scheduled to start earlier this year were held up due to lack of essential construction materials for pipe-line loading facilities.

While it could not be determined where the crude will be shipped it seems rather certain that it will not be refined in the immediate area of the Persian Gulf. Kuwait Oil Co., Ltd., is jointly owned by Gulf Exploration Corp. (Gulf Oil Corp.) and Anglo-Iranian Oil Co., Ltd.



Standard Oil Co. of Egypt (Standard of New Jersey) Abu Roash wildcat operation northwest of Cairo. Pyramids in background

Design for Petroleum Expansion Outside the United States

by R. G. Greene*

THOSE directly responsible for the exploration phase of the petroleum industry are confronted with a solution of two basic problems. These are (1) Where can additional reserves be found? (2) When are the proper times to initiate new programs? A breakdown of the two essential problems into minor subheadings reveals the subject to have many ramifications which appear rather complicated. The problem has received little attention in meetings of professional geologists and therefore greater familiarity with the difficulties incident to foreign expansion become of greater and greater interest.

The great American interest in foreign oil was initially based on the desire for markets rather than development of new reserves. This follows as our domestic companies, up to 1914, minimized the possibility that our supplies were exhaustible and only with the unprecedented demand created by World War 1 which coincided with the great expansion of automotive transportation, were they particularly interested in crude supplies abroad. That war, therefore, served as a great catalyst to expansion, and the most important phase of our foreign development history dates from that period.

The earliest known effort by an American to develop oil abroad was during 1876, when an enterprising Yankee sea captain observed oil seeps along the coast of Mexico, and he and his associates eventually spent $500,000 attempting to commercially develop them. The timing was bad as there was no demand for the poor quality of oil produced, so the first American effort abroad was a rank failure. It was not until 1900 that the first commercial American oil was produced in Mexico, and in 1914 Americans were producing in only two foreign countries, viz.: Romania and Mexico.

The history of American foreign development should really be divided into two phases, the first being development prior to 1919 and the second, a modern era, which extends to the present. During this latter era, Americans have plowed approximately $3,200,000,000 into foreign development, transportation, refining, and marketing. Of this sum, approximately 41 per cent has been spent on exploration and development and 59 per cent on transportation, refining, and marketing, and if this latter figure of 59 per cent comes as a surprise, it but indicates the importance of developing transportation, refining, and marketing as an integral part of our foreign oil program.

It is obvious that oil production abroad cannot properly be developed and exploited unless outlets for such oil are developed in world markets. This requirement is a well-recognized fact and efforts by our Government to create and maintain foreign open-door policies is a program greatly appreciated by those companies which desire to do business abroad. That foreign markets are due for continued expansion is shown by increasing rates of consumption abroad, which are almost double the rate of growth within the United States.

Reserves

Success in developing foreign oil reserves since 1919 is indicated by the following discoveries. Excluding Russia, these are:

	Bbl.
Iraq, 1927	5,000,000,000
Bahrein, 1932	300,000,000
Kuwait, 1938	9,000,000,000
Saudi Arabia, 1938	5,000,000,000
Qatar, 1940	1,000,000,000
South America	5,000,000,000
Total	25,300,000,000

*Union Oil Co. Presented at A.A.P.G., Pacific Section, meeting at Los Angeles.

The widespread nature of the geographical locations of these reserves indicates how universal was the search and it may be said that geologists, engineers, and field men practically scoured the world. It extended into every nook and cranny of North America, to every country of Central and South America, to islands of the Pacific Southwest, to Asia and Africa.

Political Risks

Of the 25 billion barrels of oil found abroad since 1919, Americans control about 45 per cent of it. This appears as a fair proportion, but to fully understand the American position, it must be assumed that, unless we use greater statesmanship than we have in the past, there is a fair chance that some of it may be lost. It is not necessary to go a great distance for an illustration, as Mexico is a perfect example of the risks to be considered when expansion programs are projected into foreign areas. Americans labored 23 years in Mexico before a barrel of oil was taken out, yet Mexico, to most of us, means the "Golden Lane" with record-breaking wells like 4 Potrero of Mexican Eagle Oil Co., which during its life, produced 110 million barrels of oil. Mexico, to a number of producers, was a great country and until 1913, when the revolution came, difficulties there were principally physical ones. However, by 1926, the problems were increasingly alarming. Under adverse conditions, many companies continued to operate until 1938, when the curtain was rung down on foreign participation in Mexico's petroleum development.

Mexico is not the only example of expropriation, and any company that enters the foreign field must be prepared to face the possibility. In Bolivia, Standard Oil Co. (New Jersey) spent 15 million dollars in exploration and development. Regardless of reasons for expropriation, Standard lost its entire investment in 1939. Probably the greatest financial loss suffered by any type of expropriation was that of the British in Russia when the Soviet came to power. At that time practically the entire petroleum industry of Russia was under control and development by the British. To date no compensation of any sort has been received.

Venezuela

A case of good relationship is illustrated by Venezuela, where American companies first initiated development in 1912. Actual credit for the discovery of production in Venezuela must be given to the Shell group which drilled the first commercial wells. Americans reentered Venezuela in 1923, and their holdings are now 74 per cent of the reserve of that country. In 1943, the petroleum laws were revised—the result of convictions that Venezuela should, to a greater extent than formerly, participate in benefits from the oil industry. This new law increased royalties, expanded basic requirements, and was accepted by operators who realized nothing could be done about it.

There has been a gradual tendency during the past 10 years for South American countries to adopt nationalized development and as a consequence much favorable exploratory territory in most of these countries is being withdrawn from foreign entry. This development toward nationalization has now progressed to the point where the only countries in South America open for foreign entry without complications are Venezuela, Colombia, Ecuador, and Peru. In Europe, nationalization of petroleum resources appears to be a policy which will be clarified in many countries within a short time, Czechoslovakia, Yugoslavia, and possibly Romania have taken steps in this direction. The move very definitely adversely affects American interests, as domestic companies were, prior to the war, active in both development and marketing throughout this area.

War Risks

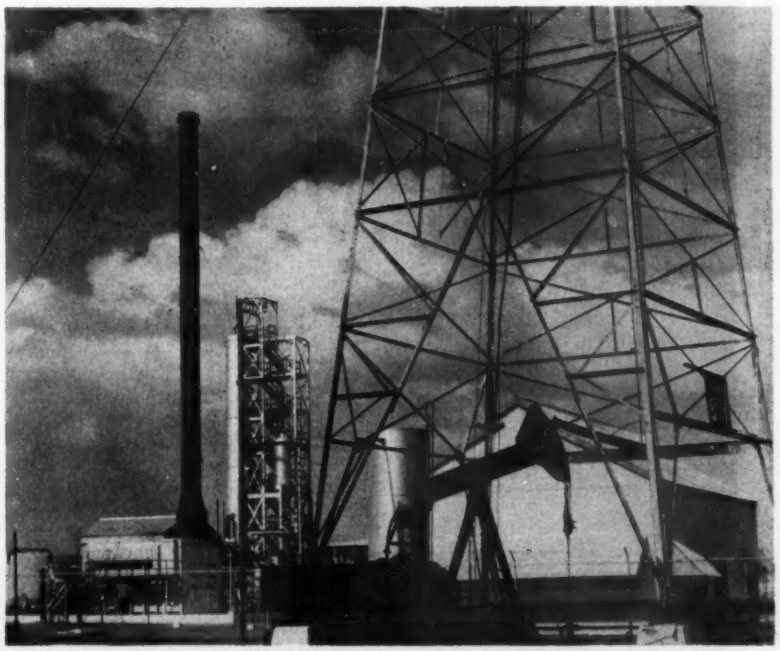
Americans suffered few losses in Europe during the first war, such losses being restricted to those in Romania where one American company was active in development. Losses were much greater in World War 2 as these losses included extensive developments for production, as well as the loss of all marketing facilities. Statistics on European losses, although incomplete, are shown by investments

in Germany prior to the war of 57 million dollars; France, 43 millions; and Italy, 38 millions. In Asia, by reason of the Japanese War, all facilities of foreign companies were lost in Japan, as well as those facilities located along seaboard of China, those in the Philippines, and those in the Netherlands East Indies. The losses to Standard-Vacuum alone in the Netherlands East Indies may be as high as $60,000,000 for only its refinery equipment.

American oil companies have carried out, since 1920, an active program of exploration and development in virtually all countries of the world where the open-door policy existed and where it was thought there was a chance to find oil. The range of this exploration and the large expenditure necessary for such work is generally not appreciated.

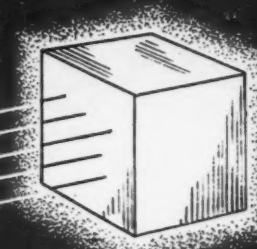
Some idea of deferred charges is given by several typical examples. One company spent 44 million dollars and 15 years in Venezuela before the first tanker of oil was exported. The Barco concession of Colombia required 23 years of effort and an expenditure of 60 million dollars before the first oil was delivered. In the Netherlands East Indies, Standard-Vacuum spent 39 million dollars before returns began and in Saudi Arabia, the Standard of California-Texas Co. group probably

(Continued on page 90)

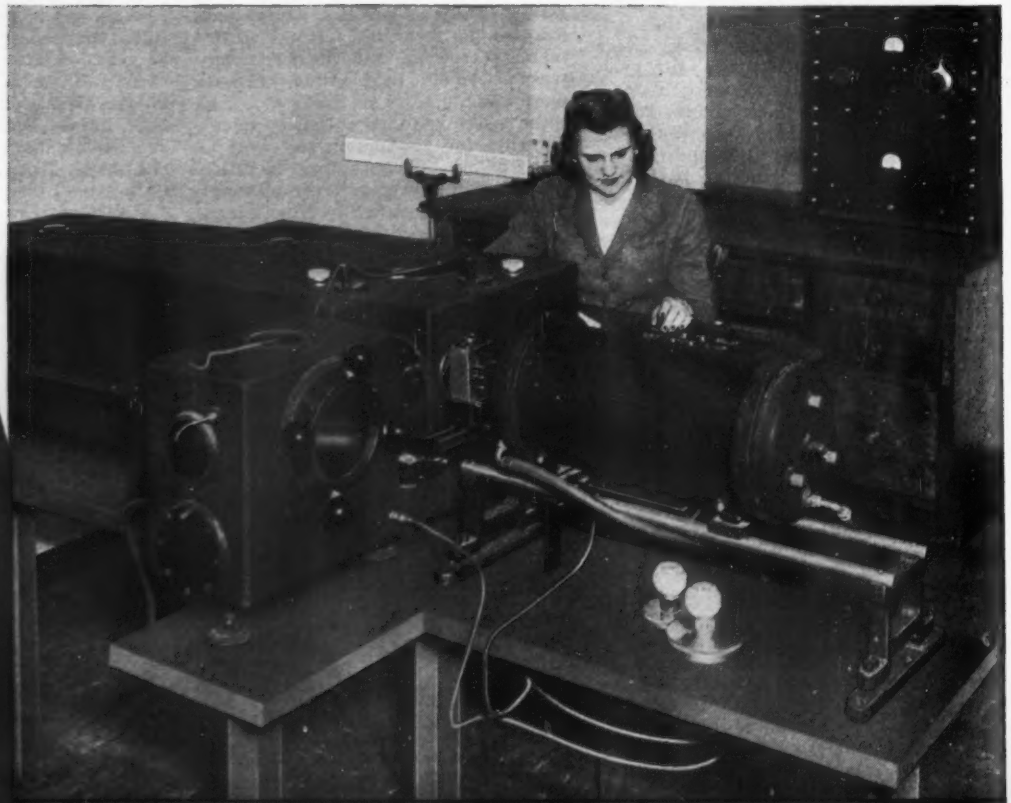


View of Creole Petroleum Corp. refinery at La Salina, in Western Venezuela. Well in foreground is owned by Venezuelan Oil Concessions, Ltd.

A ray of light.....



UOP technologist examining a hydrocarbon liquid by infrared spectrometer.



through a lump of salt!

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spent 25 million dollars before financial returns started. In the history of foreign exploration, the list is long of companies which have spent from 5 to 15 million dollars without the realization of any returns whatsoever.

Although there is a note of pessimism in this review of political and war risks, and the high cost of foreign development, an account of reserves discovered abroad indicates that if a domestic company goes into a foreign program with proper financial backing and the patience and fortitude to play out the string, the chances for success are excellent. Americans have, since 1919, spent approximately $1,280,000,000 for foreign exploration and development. As returns on this investment have already begun, it appears the American foreign reserve of about 11½ billion barrels has a deferred charge against it of about 7 cents per barrel. This, in comparison to costs of finding domestic oil, is exceptionally favorable.

National Benefits

The late war, with its wild scramble for strategic natural resources, has brought all of us to the definite conclusion that America, if it is to maintain a strong future industrial regime, must be wide awake to the possibilities of securing cheap basic materials abroad. With these materials should be classed means of transport, and this can only be done with sufficient oil at strategic points throughout the world which can be purchased in open markets. Americans, due to their holdings in the United States, Venezuela, and Colombia, are well situated in the Western Hemisphere. Moving westward, the next strategic base is in the Straits Settlements, which include Java, Sumatra, Borneo, and other islands of that area. In this region, the Standard-Vacuum group has approximately 39 per cent of the reserves.

The tremendous proved and undeveloped potential reserve of the Middle East dwarfs any other petroleum province in the world, and this fact is well known by the British, Americans, and by Russia. The principal producers there are Iraq Petroleum Co., Ltd., which is the international petroleum company developing the mandated territory of Iraq; Anglo-Iranian Oil Co., Ltd., which is producing from six fields in the southern part of Iran, and at Qatar; the Standard of California-Texas Co. group, which has an extensive reserve in Saudi Arabia and Bahrein Island. An interesting sidelight is furnished by Anglo Iranian Oil Co., Ltd., the outgrowth of British Imperial Government's desire to be in a position where it could insure its navy of an adequate supply of fuel oil.

PAW reserve estimates for Middle East were placed at

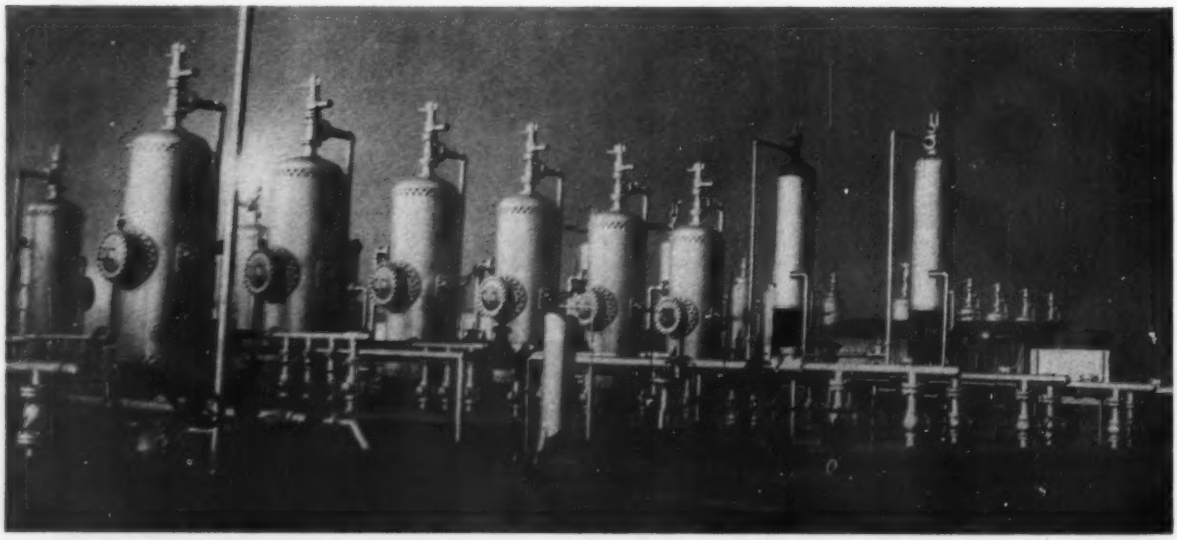
	Bbl
Anglo Iranian Oil Co., Ltd.	12,925,000,000
Shell interests	1,425,000,000
French group	1,425,000,000
N. R. Gulbenkian	300,000,000
Gulf Oil Corp.	4,500,000,000
Standard of California	2,500,000,000
Texas Co.	2,500,000,000
Standard of New Jersey	712,500,000
Socony-Vacuum	712,500,000

The total of this group is almost 27 billion barrels of which two British companies now have 53.15 per cent, or more than 70 per cent of the known crude reserves in the United States today. United States' interests are figured at 40.47 per cent of the total with 10,925,000,000 bbl., or just about one-half the total crude reserves known to exist in the U. S. When an effort is made to determine Russian reserves, one encounters estimates which run from 6 to 50 billion barrels. The tremendous area as yet undeveloped in Russia indicates that this nation may have as much as one-third of all potential reserves of the world.

Design for American Expansion

It is interesting to note, that in spite of great political and war risks and the tremendous cost of development coupled with a long-time lag necessary for success abroad, Americans have persisted in seeking and obtaining footholds in all foreign countries whenever possible. Their success in augmenting our reserves has been noted; and the prestige gained by such effort abroad will prove a great asset to this nation, not only from a political standpoint, but also from the tremendous addition to our wealth in natural resources. Assuming that the United States is definitely committed to further expansion of its influence throughout the world, it is suggested this group give some thought to the following design:

(1) The decline in domestic production and the necessity for strategic oil bases means that an increasingly greater percentage of our young professional men must move abroad; (2) that more of the smaller independent American companies pool their resources for foreign undertakings; (3) American oil companies should explore the possibility of joint company and sovereign-nation operations; (4) that we eliminate all thought of marketing combines or cartels so typical of the European way of doing business; (5) our State Department should develop long-range plans to render every assistance within its power to American companies desiring to do business abroad.



Gas separators in Posa Rica field, in Mexico. Picture taken at night using natural-gas flames

WASHINGTON WATCHING

BY HENRY D. RALPH

More OPA Excuses

WASHINGTON.—Now that the coal strike has been settled, the Office of Price Administration, as might have been expected, has found another reason why control over oil prices cannot be dropped. The latest excuse is the unsettled condition of legislation to continue—and curtail—OPA's powers.

Months ago OPA admitted that oil price controls might well be dropped and that a decontrol study was under way with the view to suspending ceilings probably before June 30. But always some crisis arose to make the time inappropriate.

Administrator Paul Porter was recently quoted as saying that it would not be wise to lift oil controls now that OPA legislation is pending in the Senate, because it might be construed as an attempt to influence legislation.

However, in a recent telegram to the Independent Petroleum Association of Texas, the administrator simply said that he is not convinced that the time is appropriate for petroleum decontrol, and that the existing situation in the oil industry does not meet the OPA standards for dropping controls.

Offers for Big Inch

IN readvertising the sale of the two big inch pipe lines, War Assets Administration has decided to call the bluff of various interests which have been playing coy and has set a closing date of July 30 for the receipt of bids to purchase or lease the lines.

All bids will be made public at 10 a.m. July 31, and no more offers will be received except in the event that all bids are rejected and the lines are advertised for a third time.

In the earlier attempts to sell the pipe lines the predecessor agencies of WAA imposed no closing date for bids. As a result, they got few firm offers. Two companies offered to buy the lines for natural gas use, contingent upon obtaining authority from the Federal Power Commission, and a number of oil interests submitted vague proposals or indicated that they intended to make offers later. WAA suspects that many of these parties have been deliberately stalling to see what others might do with the intention of submitting definite bids only if it appeared that the lines were about to be sold to somebody else. WAA hopes to smoke out the real interest in the line by its announcement that all bids will be made public July 31.

The policy adopted by the old Surplus Property Administration in its report to Congress is still the policy of WAA, namely that the lines should be kept available for oil transportation in case of another national emergency. Therefore, WAA will give preference to purchaser who will use the lines for oil and sell to gas companies only on condition that the lines be maintained in such condition that they could be reconverted to oil on short notice. This would mean that the gas could be used only for supplementing and enriching manufactured gas in eastern cities and that WAA would not permit use of the lines for gas which became the principal supply of any municipality. However, WAA officials feel that what gas companies really want is the right-of-way rather than the lines themselves, and that they would therefore be content to keep one or perhaps both of the present lines in condition for oil use as soon as they could construct a larger trunk line specifically designed for gas transmission.

Incidentally, some misunderstanding was caused by a WAA press release giving June 14 as the closing date for bids for the War Emergency pipe lines. Actually, this applied only to certain electric power transmission lines serving pumping stations in Missouri and Arkansas. These lines are being sold on condition that the purchaser agree to make power available for operation of the big inch pipe lines on demand.

OGD Moves Ahead

PLANS for calling the first meeting of the new National Petroleum Council of the Oil and Gas Division were still being perfected early this week by acting director Ralph K. Davies in spite of a scare story to the effect that the Department of Justice had vetoed the proposed membership.

What actually happened was that pursuant to a working agreement between Attorney General Clark and Interior Secretary Krug, the solicitor of the Interior Department sent Justice the list of names Davies proposed to invite to serve on the council. Justice replied by submitting a list of all the antitrust cases, indictments, and charges involving all of the nominees and companies with which they had been connected. This was submitted without comment and simply for the information of Interior officials, and Justice denied that it has any veto power over personnel of the council or that it had attempted to influence the appointments.

Davies is understood to have been disturbed over the way in which the news reached the public but not surprised at the fact that Justice had an antitrust file on more than three-fourths of his nominees, since there have been many antitrust cases involving oil companies and virtually all oil-company executives are members of the American Petroleum Institute which is currently the defendant in a civil suit. Some of the independent marketers on the list are understood to have been mentioned for antitrust cases involving other commodities than oil in which they also deal.

Davies is satisfied with the general clearance for the makeup and activities of the council given by the attorney general, and is planning to name the council without much reference to the antitrust records of the individuals. The call for the council was expected to go out during the week, and its first meeting probably will be held shortly after Secretary Krug returns from his western trip, about June 20 or 21.

The Political Angles

THIS week sees the most intensive propaganda campaign of the year over continuation of the OPA, as the Senate engages in final debate over the bill to continue price controls beyond June 30. A tremendous pressure is being put on the senators to vote one way or the other, but most observers feel that their minds are already made up and that the final vote will be for continuation of OPA with very restricted powers.

In view of this situation the political strategists are looking beyond the Senate vote to the next step. Some of OPA's supporters in the administration are now hoping that the Senate version of the bill will be so much worse, from their standpoint, than the House version that President Truman will veto it without hesitation. In this case the plan would be to ask Congress to pass a simple resolution continuing the present price control law without

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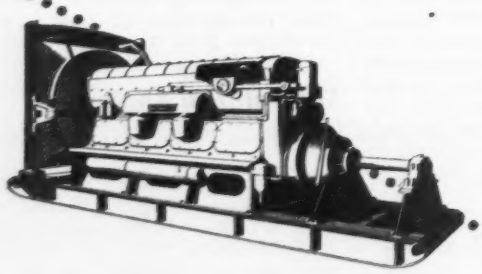

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change for two or three months in order to give Congress time to write a new law on the basis of the president's veto message. Since Congress wants to adjourn in the near future, the expectation is that it might be willing to drop the fight over OPA and let the present law stay in effect until after the fall elections.

The reasoning behind this is that opponents could tell their constituents that they did their best to modify the law, but were forced to continue the present provisions rather than have no price control at all. Some Republicans think this excellent strategy, since they figure OPA will be so unpopular by fall that the voters will register their protests against the administration in the Congressional elections.

However, it is quite possible that the bill will not come out of the House and Senate conference committee and be sent to the White House until a day or two before June 30, which is a Sunday.

Thus there might not be time for Congress to act on the veto and put through continuing legislation if the veto is sustained, and on Monday morning, July 1, there would be no price control statute on the books. That would give the president the choice between no controls at all and the distasteful new bill, and some of his advisors would urge that he veto the bill anyway and blame inflation on the Republicans.

Many Republicans would be quite content with this on the theory that without any OPA, production would increase so rapidly that the voters would thank those legislators which killed OPA. On the other hand, a lot of Democrats think that without OPA there would be a sudden boom and then a big depression in a couple of years which would vindicate their position in favor of continued controls and insure a Democratic victory in 1948.

Thus the fate of OPA depends less on the merits of the amendments being debated in the Senate this week than on long-range political strategy and economic prognostication.

Average Refinery Yield of Residual To Shrink Sharply, Hulse Predicts

ASBURY PARK, N. J.—A decline in the average refinery yield of residual fuel during the next 15 to 20 years from the present 26 per cent to possibly as low as 10 per cent was predicted here last week by S. H. Hulse, Esso Laboratories, in a talk before members of the Fuel Oil Distributors Association of New Jersey.

Refineries in the United States will maximize yields of gasoline and distillate fuels in the years to come in order to meet the heavy demand for these products, Hulse said. It will be necessary to import residual fuel oil in the years immediately ahead in order to meet the deficit in heavy fuel stocks from domestic crude sources he added.

"This situation, in reality, is for the best," he said, "in that such imports of fuel oil or heavy fuel-producing crudes will be supplementary rather than competitive in nature, permitting domestic crude to be run for maximum yields of more valuable products."

If the anticipated demand for burner and diesel fuels is to be met, it is necessary that refiners use to best advantage all of the distillates in this boiling range that can be produced directly from crude and from processes including cracking, Hulse said, after pointing out that competition exists between the diesel engine and the domestic oil burner for distillate fractions having the same boiling range.

The Esso official said that there should be no cause for concern regarding adequate supplies of fuel which will meet the requirements of existing oil-burning appliances and central heating systems as well as those which are expected to be sold in the coming 10 to 15 years.

Other speakers included E. T. Knight, economist of Atlantic Refining Co., who predicted that the oil industry will find enough reserves to meet the 5,400,000 bbl. anticipated daily demand by 1965. In the last 10 years, he said, the oil industry has added 2,100,000,000 bbl. of crude to its reserves annually. And at this rate the industry will be able to find the 40,000,000,000 bbl. needed in the next 20 years, Knight said.

Hulse cited forecasts of the trend of total petroleum demand in the United States showing about 5,650,000 bbl. daily by 1950 and 5,900,000 bbl. daily by 1965. In comparison, he said, the total demand was only about 3,900,000 bbl. daily in 1939 and the peak wartime demand just prior to V-J day was about 5,600,000 bbl. daily. A partial account of Hulse's remarks follows:

"After considering the various uses of kerosene, such as for illumination, as range oil, and for space and water heating, it is believed that the increase in demand will be moderate over the next few years. Domestic demand is estimated at about 236,000 bbl. daily in 1950 as compared to about 208,000 bbl. daily for 1946, an increase of approximately 13 per cent over 1946 volume. This takes into account the possible increased use of liquefied petroleum gases as a substitute for kerosene in certain applications.

"There are about 2,500,000 vaporizing pot-type burners in use at the present time and the manufacturers of these burners have estimated that an additional 750,000 burners will be sold annually during the next 5 years.

"At present, there are an estimated 2,500,000 power-operated oil burners in service in homes in the United States which normally consume an over-all average of a little more than 50 bbl. per year of domestic heating oil. Projections of the market for home-heating indicate a substantial increase in oil-burning installations so as to reach approximately 3,750,000 in 1950 and 4,800,000 by 1965. This means an increase in demand for domestic fuel from about 350,000 bbl. daily in 1946 to approximately 500,000 bbl. daily in 1950 and 565,000 bbl. daily in 1965, an over-all percentage increase of about 60 per cent.

"It is important to recognize and to point out another field in which a marked expansion in the demand for distillate fuels is anticipated, namely, utilization of diesel engines. These high speed engines require a paraffinic fuel which overlaps the boiling range of kerosene and No. 2 heating oil.

"The distillates from the catalytic-cracking process available for fuel oils lack 'front end' volatility because refiners have found that they can economically divert to gasoline the light distillates which would have imparted this volatility. Thus, a downward trend in volatility of heating oil, particularly No. 2 fuel oil, can be expected. As with the better known thermal cracked oils, the catalytic-cracked oils have lower A.P.I. gravities and lower diesel index.

"The effect of these changes is shown by the trend which has taken place in No. 2 fuel oil quality here in New Jersey in the last 8 years, as shown by the table.

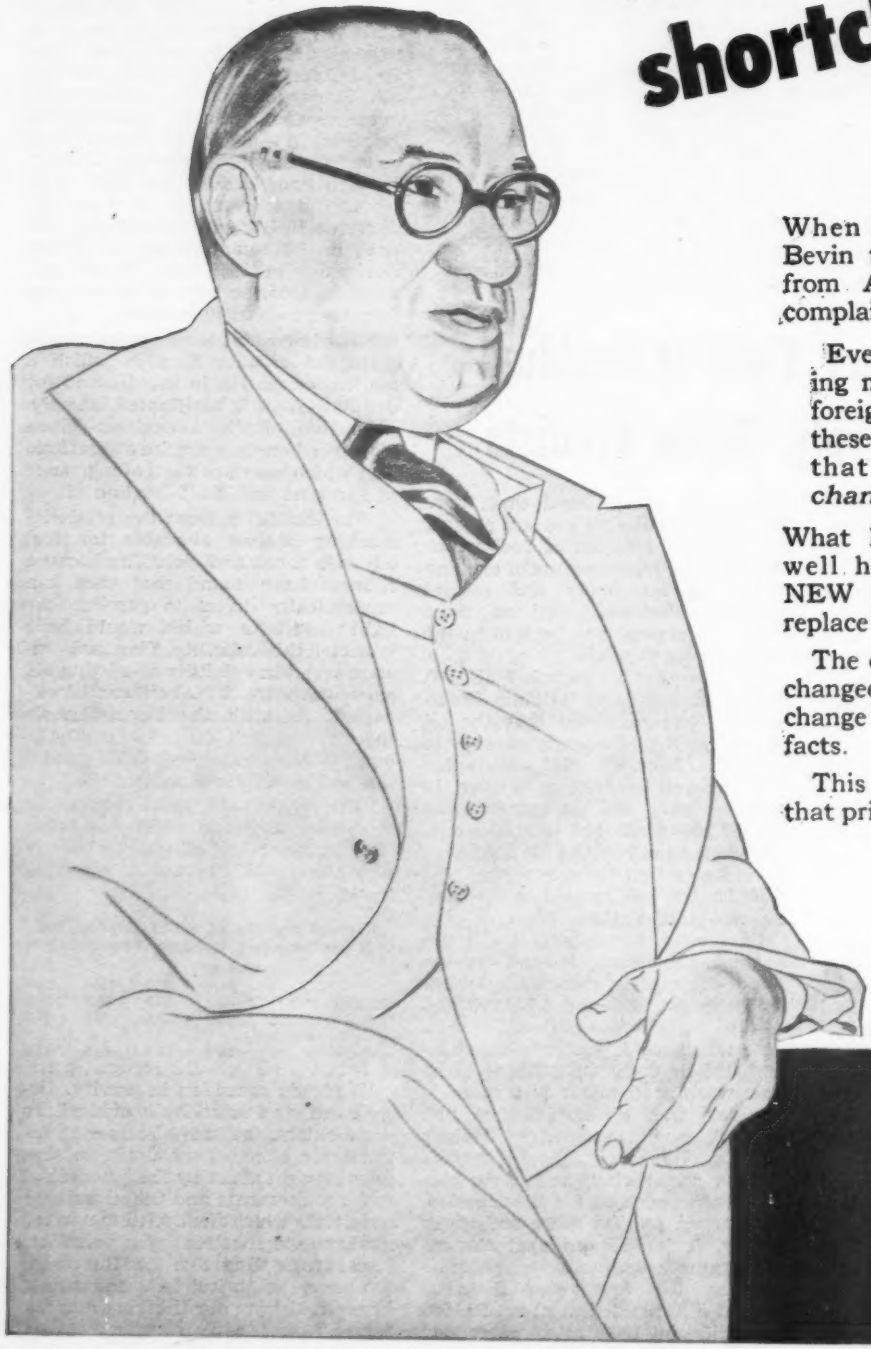
Average Quality of No. 2 Heating Oil Major Suppliers, Northern New Jersey

	Last 4 pre-war years	1942	1944	1945
Gravity °A.P.I.	36.4	35.9	32.6	32.9
Diesel index	52.8	52.0	43.5	44.5
Per cent distilled at 440° F.	20.1	15.9	10.5	13.0

"A steady reduction in gravity, diesel index, and volatility is evident. To some extent, the 1944-45 situation reflects the effect of the drain on supplies brought about by the Navy diesel fuel requirements and other wartime conditions which finally led to relaxed quality specifications for distillate fuels under Directive 59. But these figures are historical facts and cannot be omitted from our thinking into the future."

then he said to himself:

"Facts don't change.... but they can shortchange"



When England's Ernest Bevin took over the reins from Anthony Eden, he complained:

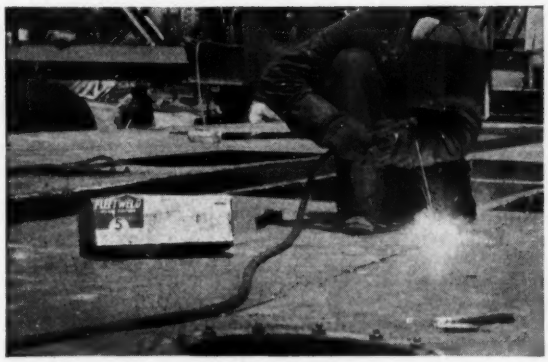
> Everyone is expecting me to change our foreign policy. What these people forget is that *facts never change*."

What he didn't say, but well he knows, is that NEW FACTS constantly replace old facts.

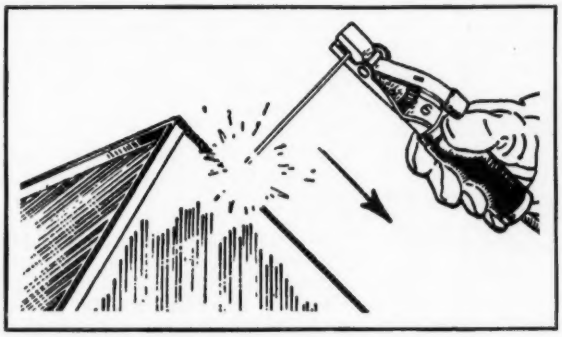
The old facts remain unchanged—but the new facts change the status of the old facts.

This example shows how that principle works out . . .

LOOK, ERNIE, how new facts about how to use "Fleetweld" change the speed of oil country welding:



50% FASTER. On butt joints, such as for the tank shown, good fit-up of plates (gap no more than 1/8"), often cuts welding time in half. For 1/4" plate, welded with "Fleetweld 5" Electrode, arc speed for 5/32" gap is about 2.6" per min.; for 1/8" gap it is 4" per min. . . . 50% faster.



33% FASTER. Mud samplers, tanks, troughs, etc., made from sheet metal are now being welded at speeds of as high as 40" per min. by sloping the joint 45° and welding downhill (compared to 30" per min. for flat position).

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ARC WELDING

New Designs Make Cat Cracker Economic for Small Refiner

by Arch L. Foster

WICHITA. — America's natural resources are being increased very materially by the results of scientific research and the optimum utilization of these raw materials for the greatest production of valuable products, Dr. Harold Vagtborg, president of the Mid-West Research Institute of Kansas City, told the Wichita section of American Chemical Society at its eleventh annual meeting here last week. He outlined some of the important developments in syntheses from petroleum, natural gas, and other raw materials. We have realized the necessity for conservation of these raw materials only recently, Vagtborg stated, materials which nature required millions of years to produce. These results are being realized through systematic research, he said, to use conservatively by main and byproducts. The petroleum industry has outstripped most others in this respect, he said.

A large number of reactions are being employed to produce a rapidly increasing list of products of commercial importance from petroleum and natural-gas hydrocarbons, W. R. Pierce, chemical engineer with Phillips Petroleum Co., Bartlesville, Okla., showed in discussing the applications of chemical synthesis methods to hydrocarbons. Plastics and resins will form an increasingly greater part of this chemical output. Among the most common reactions are those of polymerization and condensation with olefins such as ethylene and butenes; the aldol condensation, manufacture of glycols from olefins and other unsaturates, use of diolefins such as butadiene and isoprene, for the synthesis of rubber.

The ideal sulfur-removal process should be applied to the crude in the field, to eliminate the threat of sulfur corrosion and other problems from the refinery entirely, E. T. Scafe, Socony-Vacuum Oil Co., Inc., stated in discussing the sulfur situation. The method should eliminate sulfur as hydrogen sulfide and should require only infrequent regeneration of catalyst. Zinc oxide gives the greatest reduction in sulfur content of all catalysts tested. Anhydrous hydrofluoric acid as a solvent reduces the sulfur to 0.3 to 4.0 per cent total sulfur in the crude; the operation seems to approach that limiting value, which means that much of the sulfur compounds are hard to decompose or to remove.

Desulfurization with anhydrous HF prior to catalytic cracking means improved yields of motor gasoline in terms of the cracking charge, Scafe stated. An aluminosilicate cracking catalyst is one of the most effective desulfurization catalysts, without any oxide promoter, this investigator reported, showing yields by volume of up to 90 per cent. For a reagent such as zinc oxide the best carrier appears to be one with cracking activity, such as the aluminosilicates.

Cracking High-Sulfur Crudes

In cracking high-sulfur crudes such as Slaughter-Duggan crude, the following tabulation shows the comparative results with and without pretreatment of the charge with HF.

	Untreated oil	HF treated oil
Charge stock—sulfur, %	1.71	0.81
Yields, vol. %:		
Motor gasoline; 10 R.v.p.	48.1	51.6
Cycle stock	44.8	36.3
Excess butanes	6.8	11.6
Gasoline inspections:		
Sulfur, %	0.14	0.048
Octane No., clear (A.S.T.M.)	72.8	77.5
with 3 cc. TEL	81.7	85.9
Octane No., clear (Research)	78.3	83.9
with 3 cc. TEL	88.9	93.9
Cycle stock, sulfur %	1.37	1.18

Scafe made three suggestions for a more firm basis for sulfur specifications: (1) replace the present qualitative sulfur test with a quantitative test for sulfur or sulfur corrosion; (2) write specifications on basis of permissible sulfur content rather than to base it on the behavior of sulfur on polished copper; (3) standardize the quantitative test and eliminate all other tests.

In discussing Thermofor catalytic cracking for the small refiner, the process is both economically feasible, and practical, H. D. Noll and R. E. Bland of Houdry Process Corp. told the members at the meeting. The unit can be built to process upwards of 1,000 bbl. of charge per stream day for virgin stocks ranging from heavy vacuum distillates to heavy naphthas, Noll stated. The unit has a high degree of flexibility, is simple in design, and its operation is characterized by total liquid recoveries of 97 to more than 100 volume per cent.

Its economics show that with typical crudes and prices of the Mid-Continent gasoline can be made for 4.8 cents per gallon not including depreciation and taxes, Bland stated. The activity of the catalyst is an important factor; the survey showed that with a typical commercial clay catalyst, optimum activity is with the 30-31 A. I. (Activity Index) range, which range requires an average rate of catalyst replacement of 0.5 to 0.7 lb. per barrel of charge, at a cost of 2 to 3 cents per barrel. The average replacement made necessary by mechanical losses of catalyst (0.1-lb.-per-bbl. charge) is too low, resulting in only 26 A. I., a value which is too low for profitable plant operation. High activity level is also affected strongly by carefully controlling regeneration conditions by zone regeneration of spent catalyst.

At least three methods may be used to improve the octane rating of motor fuels, Davis Read, Universal Oil Products Co., stated in discussing means for octane-rating betterment. Uniforming is a new development still in the pilot-plant and laboratory stage, which operates at 900°-1,000° F. and 500 to 1,000 psig. in the presence of a high hydrogen concentration and a catalyst not identified by the speaker. By its use pilot-plant improvement of octane rating may be as high as 15 to 20 numbers, clear, and about the same range with 3 cc. of TEL; the process should be operated so as to make a small excess of hydrogen to supply that required in the reactor. The presence of hydrogen reduces materially the amount of carbon deposited so that the catalyst remains comparatively clean after long periods on stream.

Other methods for gasoline improvement include desulfurization reforming, thermal and catalytic cracking via the Fluid process. Only slight increases in octane rating of motor fuels should be expected in the immediate future, Read said.

Bedell Elected Chairman

H. L. Bedell, research chemist for Socony-Vacuum's White Eagle Division, Augusta, Kans., was elected chairman of the Wichita Section of the American Chemical Society. The new vice chairman is Eldon Means, research chemist of Wichita. B. F. Hartman of Augusta was reelected secretary-treasurer while Lloyd McKinley of Wichita and T. A. Cranston of Augusta were made board members. The present counselor from the section, B. H. St. John of Wichita, will be succeeded by Dr. L. C. Kreider of Newton, retiring section chairman.

Tar Sands Plant Burned

NEW WESTMINSTER, B. C. — A plant built here to experiment with the extraction of gas and oil from Alberta tar sands was recently destroyed by fire, as it was ready to commence operations.

Gasoline Prices Only Fraction Below Ceiling

GASOLINE prices throughout the Middlewestern and Gulf Coast areas stood only a fraction below ceilings this week, representing near-complete recovery of declines in quotations early last winter.

Regular on the Group 3 basis was selling upward from 5⅝ cents. Last week, the high of the posted quotation rose to the ceiling of 6 cents. Observers were predicting a further tightening of the market and considered another advance in the low range of the quotation in the making.

The new prices for regular grade are the result of a series of advances beginning late in April when the market turned upward under increasing consumption and heavy buying by many major companies.

Standard Oil Co. (Indiana) last week raised tank-wagon gasoline prices 3/10 cent, further indicating the continued strengthening of the market. Ethyl was generally selling ¾ cent above regular—ranging from 6⅜ to 6¾ cents.

In other petroleum products, kerosene was reported showing a firmer tone early this week. Price generally ranged upward from 4⅜ cents.

Demand for residual continued strong. The heavy demand for this product was interpreted in the New York area as a reflection of the general fuel shortage created by the coal strike.

The gasoline market in New York held firm with one supplier stating that he had stopped offering 65 octane because of better returns in the house-brand market. He said he is blending lower-grade gasoline with premium in order to get more regular. Several other suppliers were reported in the market for housebrand for blending into premium that would meet new lowered octane specifications.

Prices of natural gasoline were unchanged early this week, but the market in this product also was showing firmness and another price rise was regarded as possible.

Filling station sales during April were 41 per cent greater than during April of last year and 1 per cent higher than March, according to a report of the Bureau of Census. The increase compares with a general rise in retail sales of all types of 34 per cent.

Pressure Maintenance Plan Approved by Commission

AUSTIN. — Decisions have been handed down by the Texas Railroad Commission approving pressure maintenance operations in East White Point field, San Patricio County, and amending a previous order to permit cycling operations in South Mineral field of Bee County. Notices of hearings were given on gas repressuring projects in Archer and Young counties.

The Plymouth Oil Co.'s petition to conduct pressure maintenance operations by injecting natural gas into the Brigham sand reservoir in East White Point field was approved as a conservation measure, and operations were scheduled to commence on May 5.

Gasoline Production Corp.'s application to amend the order permitting cycling of gas from gas wells in West Tuleta, Ray and Mineral fields, Bee County, to include South Mineral field in cycling operations, was granted. Gasoline Production Corp. recently unitized 1,394 acres in the field for the purpose of recycling. The order was further amended to include South Mineral field in the sale of residue gas resulting from production of the Slick and Luling zones. Annual volumes permitted are: 4,000,000,000 cu. ft. from West Tuleta field, and 1,000,000,000 cu. ft. from Ray, Mineral, and South Mineral fields.

Application of Fain & McGaha to repressure with gas the producing sands in Daume and East Holliday fields, Archer County, and to transfer the allowables of input wells to other wells on the same lease, will be heard June 20. Hearing on the application of J. T. Gray to repressure his H. F. Haygood lease, Young County, will be held June 14.

Maritime Commission Gets 1,000 Offers for Ships

WASHINGTON. — The U. S. Maritime Commission last week was sorting more than 1,000 applications for the purchase of surplus war-built ships.

The applications were received shortly before the deadline expired for the first preference period under the ship sales act. The commission is now screening the applications. Most of them are seeking more expensive and better built vessels, according to a commission official. The agency has the task of selling more than 4,500 surplus ships, including some 700 tankers.

1944 Minerals Yearbook Now Available to Public

WASHINGTON.—The 1944 edition of Minerals Yearbook is now available for public distribution, according to Dr. R. R. Sayers, director of the Bureau of Mines.

Prepared annually by the economics and statistics branch of the bureau, the Yearbook was withheld from general distribution during the war because of the censorship on foreign trade information and other data. Certain preprint chapters, however, were distributed separately throughout the war, and nearly all of the chapters in the current volume have been issued individually, Dr. Sayers said. Bound copies of the 1944 Yearbook may be obtained for $3 each from the Superintendent of Documents, Government Printing Office, Washington 25.

Penn Grade Association To Review Research

OIL CITY, Pa.—Progress made in the production research program sponsored by the Pennsylvania Grade Crude Oil Association will be reviewed at the association's twenty-third annual meeting June 27 in the William Penn hotel, Pittsburgh, according to officials of the organization.

W. F. Clinger of Warren, Pa., president of the association, will open the general conference at 10 a. m. The opening session will be devoted to reports on all phases of the association's production research program. Advertising and the plan of unit operation of multiple oil leases will be discussed at a luncheon and the afternoon session. The 1-day meeting will be concluded at a banquet at 7 p. m.

DEATHS

George Draper, chief clerk in the transportation division of Phillips Petroleum Corp., died June 7 at his home in Bartlesville, Okla.

G. E. Gilmore, 80, independent oil operator in Houston for 40 years, died June 2 in Houston.

George W. Hooker, 83, retired chairman of the manufacturing committee of Socony-Vacuum Oil Co., Inc., died June 2 at Baltimore, Md. Hooker supervised refinery construction in Poland and Hungary and at one time was director of Deutsche Vacuum Oil Co. in Vienna.

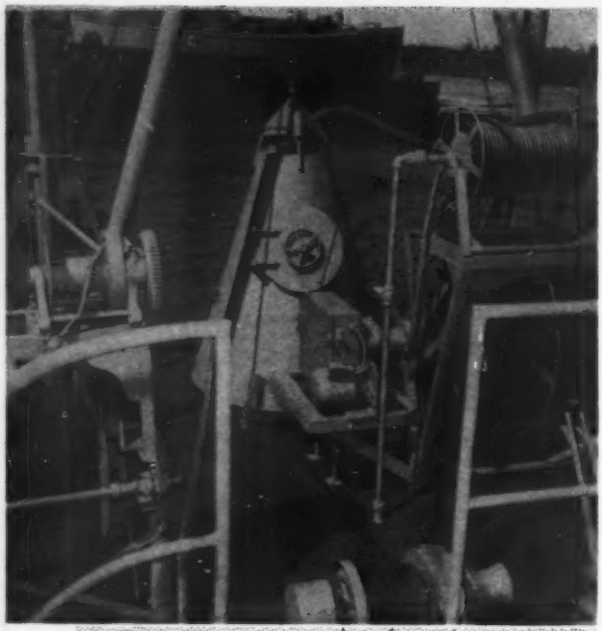
Edward E. Simpson, 77, general manager of Oklahoma Eastern Oil Co., died June 4 at his home in Tulsa. Simpson, a native of Newcastle, Pa., worked in the fields of Pennsylvania and later was a drilling contractor in eastern fields.

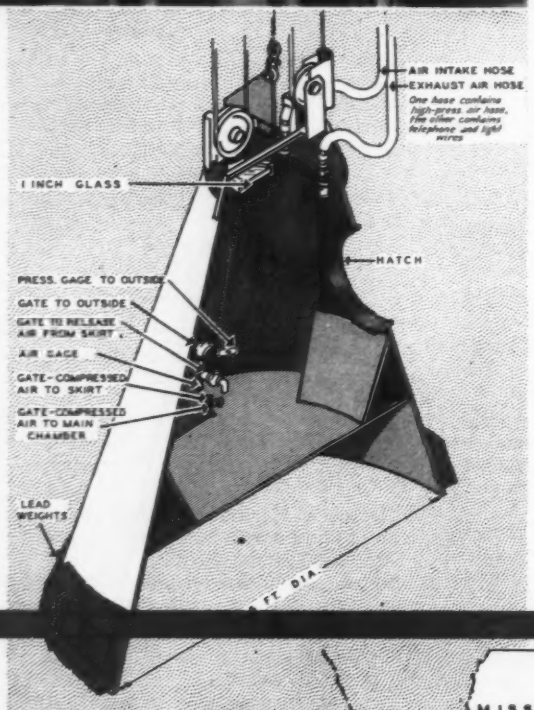
Michael Conisha, 51, foreman of the field machinists division of the Bayway refinery of Standard Oil Co. of New Jersey, died June 3 in Elizabeth, N. J.

Clarence R. Murphy, 57, Centralia, Ill., drilling contractor, died recently in Centralia. He was in Argentina for Carter Oil Co. in 1928 and 1931.

Exploring

by Charles J. Deegan




AIR INTAKE HOSE
EXHAUST AIR HOSE
One hose contains high-press air hose, the other contains telephone and light wires
1 INCH GLASS
HATCH
PRESS. GAGE TO OUTSIDE
GATE TO OUTSIDE
GATE TO RELEASE AIR FROM SKIRT
AIR GAGE
GATE-COMPRESSED AIR TO SKIRT
GATE-COMPRESSED AIR TO MAIN CHAMBER
LEAD WEIGHTS

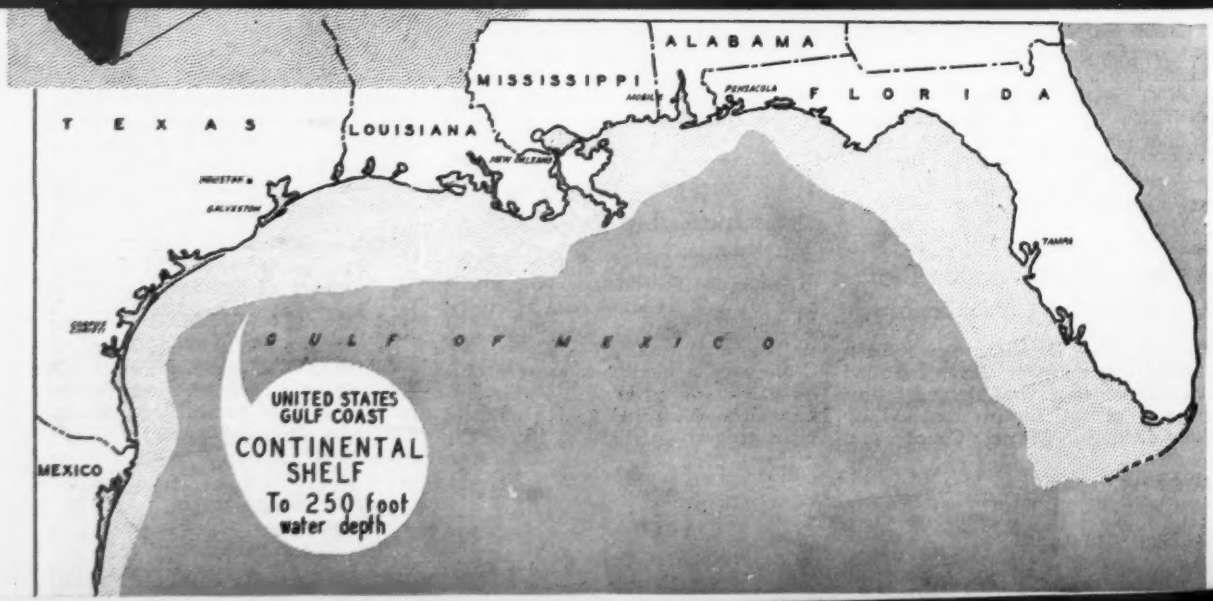
ONE of the most attractive areas for oil exploration lies off the Gulf Coast, under water. As the drilling rigs approach the water's edge, and creep out into shallow waters, the necessary drilling techniques are being developed. But the exploration branch of the industry must operate several years ahead of the drilling, therefore its under-water techniques must be perfected ahead of the drillers.

Under-water exploration must be primarily geophysical, and of the two most commonly used geophysical instruments, the gravimeter is the reconnaissance method most widely used, with the seismograph as the detailing instrument. The reconnaissance instrument techniques must come ahead of the detailing instrument techniques, and in this instance, unfortunately, the problems to be solved in connection with reconnaissance work are more difficult than those connected with the detailing. The seismograph can be used over water up to about 600 ft. deep at the present time, although this would involve considerable expense.

Recognizing this problem, many geophysical con-

Top: One model of the shallow-water type of diving bell is shown on the rear of the specially equipped and adapted boat with which it is used. The hatch in the side of the bell is for entrance and exit of the observer. Air hose, telephone line, and electrical circuit for the gravimeter, as well as the lowering and hoisting equipment, are shown

Left: This is a general schematic diagram of all models of the shallow bell. The broad base, low center of gravity, and low profile aid in keeping the bell steady despite wave and tide action. The broad base also eliminates much trouble where the bottom is soft mud



the Continental Shelf

The geophysicists are resourceful scientists. If ordinary methods of doing the job will not work, they invent new ones. Under water; on the ground; or in the air; they keep probing the earth's secrets in spite of all obstacles.

cerns have been attacking it. Robert H. Ray Co., geophysical engineering concern of Houston, has been designing and experimenting with various types of diving bells for use in connection with gravimeter work since the fall of 1944.

Two general types of bells have been developed and used successfully by this company. One type, of which several models have been developed, is being used in shallow water, up to 40 ft. deep. The other type is a deep water bell, suitable for depths up to 250 ft. deep.

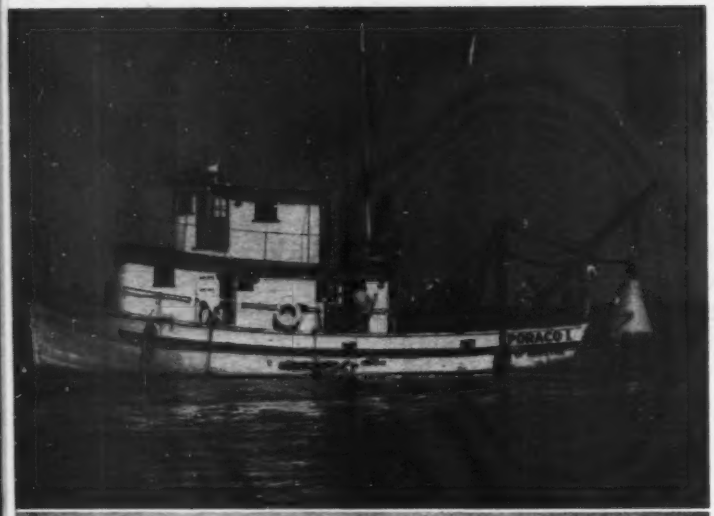
The shallow water bells are being used to the greatest extent at this time, and in one case, a high record of 25 station readings in 1 day was achieved. The deep water bell is being used by only one party at this time, with 10 station readings in a day the highest

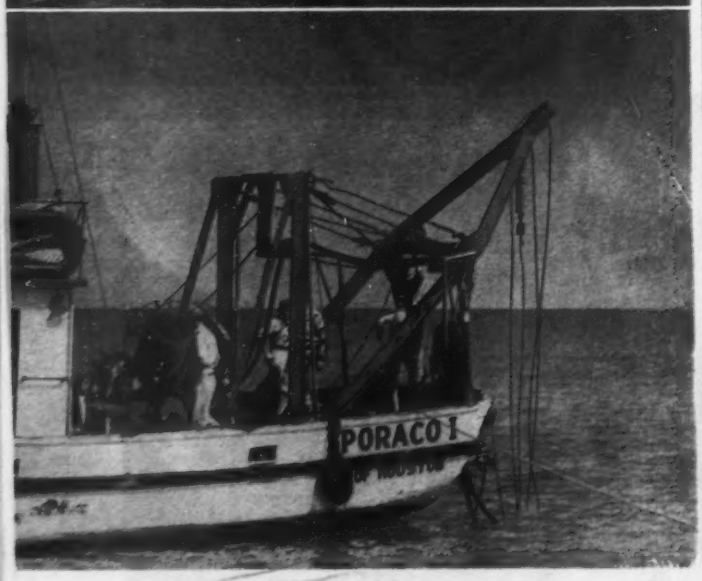
This is the first of a sequence of illustrations of actual operations with another model of the shallow type bell, working in somewhat deeper water. Henry Howell, observer, has entered the bell through the side hatch, and is waiting for Eugene Frowe to hand him the gravimeter

Bottom, right: Henry Howell shows the position he will take with the instrument when making a reading on bottom. The headphone set he is wearing is barely visible. He is in communication with the deck crew at all times

Below: The same bell en route to operations. This boat is a specially adapted Higgins model, and can operate in water only 2½ ft. deep. The poles at the four corners of the boat can be lowered to serve as anchors when the bell is on bottom, to prevent drifting away from the bell

Exploring the





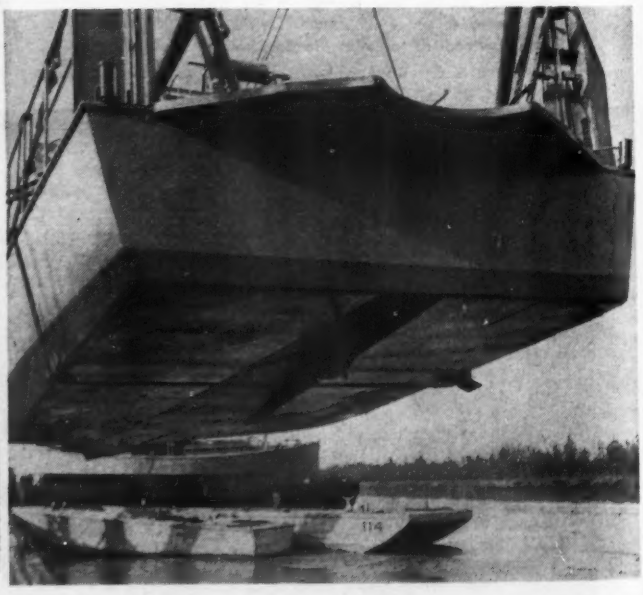
record to date. Successful operations have been carried on off the coast of Cuba, in Lake Maracaibo, Venezuela, and quite extensively off the U. S. Gulf Coast. The accompanying illustrations show some of these operations, and schematic diagrams of the two general types of bells.

Top, left: With Howell and the instrument inside, the hatch has been firmly closed, lines checked to avoid fouling, and the bell is being lowered into the water for a station reading. Note the lead weights attached to the bottom of the bell. The flexibility of operation of this model bell in water of varying depths is greatly increased by this feature. Note also that this is a different type of boat, suitable for operation in deeper water

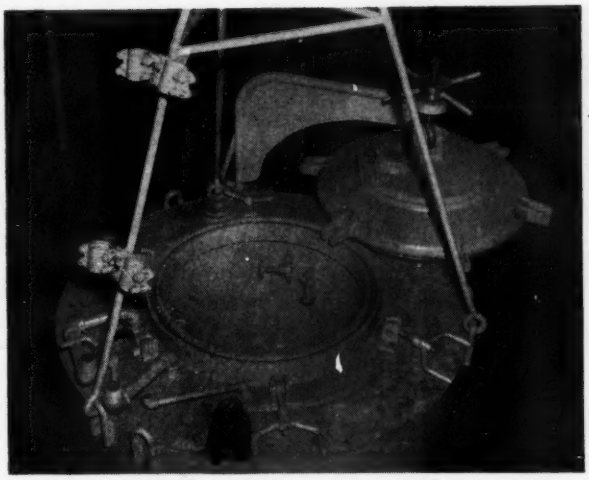
Left, center: The bell is partly submerged and the deck crew is busy with its duties. Ed Pelligrin is bending over, making an adjustment; Floyd Thorn is operating the air-hose reel; J. C. Pollard is talking via 'phone to Howell inside the bell; and Eugene Frowe is standing on the ship's fantail, seeing that all lines are clear

Bottom, left: The bell is on bottom, as shown by the slack in the hoisting lines. Howell is taking the gravimeter reading. Meantime, as everything seems to be functioning smoothly, the deck crew relaxes

Below: This bottom view of the Higgins boat that has been adapted for use with the bell in very shallow water shows the tunnel for the propellor and rudder that permit operations in waters as shallow as 2½ ft.



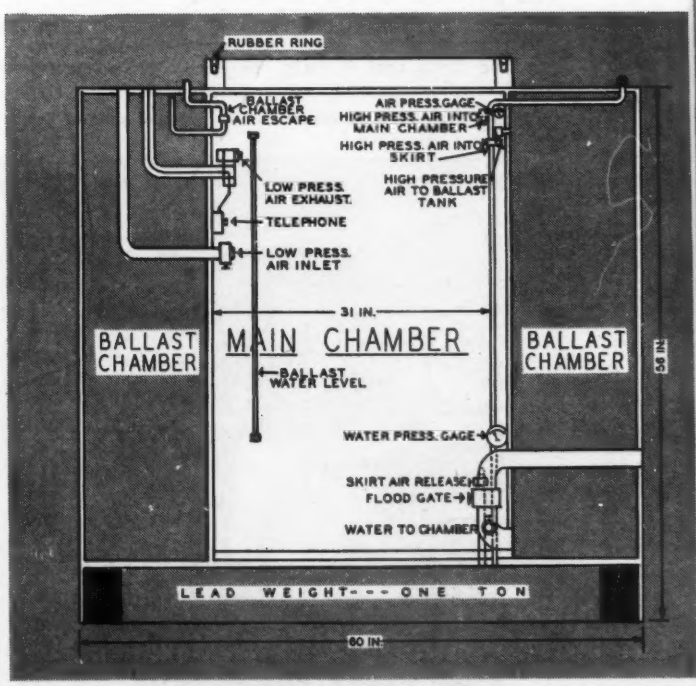
Continental Shelf



A close-up of the top part of the deep bell, with the hatch open. The construction of the bell is that of two concentric steel cylinders, water-tight welded to a common circular base. The welded steel top shown here seals the annular space between the inner and outer cylinders. This annulus between the cylinders is used as a ballast chamber, the water being allowed to flow in, or being ejected by compressed air, as desired. The observer works inside the inner cylinder, which is covered with a removable lid, shown here swung to the open position. The center section of this lid can be opened from inside the bell, to permit the observer to escape in an emergency

This is the deep-water bell used in waters too deep for safe operation of the shallow models. It is designed to operate in water as deep as 250 ft. and still have a structural safety factor of two. With the gravimeter and observer inside, it weighs 5,000 lb., but since it displaces 5,400 lb. of water, it will still float, unless the observer opens a valve and lets water into a ballast chamber. It is lowered from a barge, or boat, by means of cables attached to the supporting yoke at the top. When on bottom, it rests on the tripod legs. Ten stations in a day is the best record achieved to date with this bell

This schematic diagram of the deep water bell, with lid and tripod legs removed, reveals the operating features. Low-pressure intake and exhaust air lines for the observer in the inner cylinder are shown in the upper left. The observer normally works in air at nearly atmospheric pressure. The telephone and electric circuit wires for the gravimeter run inside the low pressure exhaust air line. At the upper right is the high-pressure air intake for blowing out the ballast chamber, jetting the skirt, or, in an emergency, supplying high pressure air to the observer, if his low pressure line should fail. The ballast chamber (in the annular space between inner and outer cylinders) has an air vent, shown in the upper left; and a water intake, shown in the lower right. In diving, the observer opens the ballast chamber air vent and also the water intake valves at lower right, while keeping the high-pressure air intake valve closed. This permits water to fill the ballast chamber and drive the air out. Coming up, the observer closes the air vent valve, and opens the high pressure air intake, which forces water out of ballast chamber. For safety the observer has access to two separate sources of air, and if both should fail, the inner cylinder contains enough air volume to sustain him until he can be hoisted to the surface. If the hoisting winch should fail, but high-pressure air intake remain O. K., the observer can blow the ballast tank empty and the bell will float to the surface. If everything failed, as in the event of the ship's sinking, he can flood the inner cylinder until it builds up sufficient pressure to permit him to open the hatch in the center of the lid, and escape. For very deep water, a submarine type escape lung will be provided. All diving operations are supervised by experienced, Navy-trained divers, who are always prepared to take a line to the bell, if anything should go wrong



GASOLINE FROM NATURAL GAS

by P. C. Keith

CONSIDERABLE interest has been exhibited recently in the possibility of developing a process for making gasoline from natural gas at a cost competitive with the cost of gasoline from crude oil. Such a process would make natural gas this country's first important source of motor fuel independent of petroleum. The need for a substitute oil source grows steadily as withdrawals from our crude-oil reserves continue to exceed the rate of discovery of new deposits. The situation was of course aggravated by World War 2, but it promises to remain a point of real concern in the postwar period. Just how long it will be before we face a really serious crude-oil shortage is a matter of conjecture, but this much is certain: our oil reserves are dwindling.

The proven reserve of natural gas, on the other hand, have increased materially in recent years, and the indications are that this trend will continue. In fact, the present production rate is only half the rate of discovery. If the production rate were doubled, thereby approximating the rate of discovery, and if this incremental production were converted to gasoline and oil, motor-fuel production would be stepped up by 25 per cent. Given a satisfactory natural-gas-to-gasoline process, then, it is evident that natural gas could become an important factor in the country's oil economy.

Furthermore, the manufacture of gasoline from coal is only one step removed from the manufacture of gasoline from natural gas. With our huge coal reserves, an economic coal-to-gasoline process would have the effect of underwriting this country's gasoline and oil requirements for centuries to come.

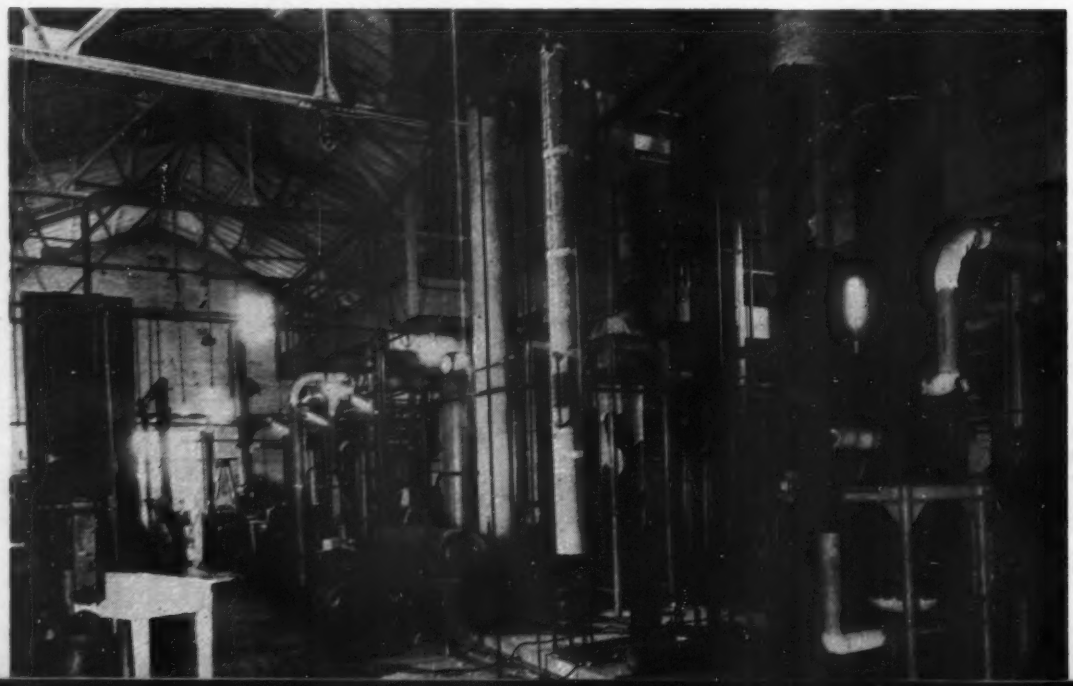
THE CARTHAGE Hydrocol Project:
DRY NATURAL GAS → GASOLINE
2½ ¢ per gallon (operating)
5¼ ¢ per gallon (all charges)
OXYGEN FROM AIR
METHANE
COMBUSTION OF CH_4 AND O_2 TO FORM CO AND H_2 HYDROCOL GAS
SYNTHESIS REACTION
PRODUCT RECOVERY SYSTEM
DE-OXYGENATING AND TREATING
GASOLINE
DIESEL OIL
ALCOHOLS
Will this process eventually place a $2/bbl. ceiling on crude oil ?
Will this process make natural gas worth 17¢ per M.C.F. ?

Hydrocarbon Research, Inc., has developed an economic natural-gas-to-gasoline process. Known as the Hydrocol process, it consists of the conversion of natural gas to a mixture of carbon monoxide and hydrogen, followed by catalytic reaction to produce liquid hydrocarbons boiling substantially within the range of gasoline. Byproducts are high-grade diesel oil and oxygenated compounds such as alcohols.

The first commercial application of the Hydrocol process is to be made by Carthage Hydrocol, Inc., in a plant soon to be erected at Brownsville, Tex. This plant, to be engineered by Hydrocarbon Research, Inc., has been designed to process approximately 64,000,000 cu. ft. of natural gas per operating day and to produce the following: Motor fuel, 5,800 bbl. per day; synthetic diesel oil, 1,200 bbl. per day; crude alcohols (in water solution), 150,000 lb. per day.

The finished gasoline produced by Hydrocol with a Reid vapor pressure of 10 lb. has a clear octane number of 80 C.F.R.M. or 88-90 C.F.R.R. This quality of gasoline compares favorably with that produced by catalytic cracking of distillate fractions from petroleum. The diesel oil has a grav-

View of towers in the Hydrocol process demonstration plant, Hydrogen Research, Inc., Olean, N. Y.



ity of about 38° A.P.I., a cetane number of 45-50, and a pour point below 0° F. The oxygenated compounds in water solution consist mainly of acetaldehyde, acetone, and ethyl, propyl, butyl, amyl and heavier alcohols. This last product offers an extremely attractive source of chemical raw materials.

The Hydrocol process calls for the following operations:

1. The recovery of approximately 0.25 gal. of natural gasoline and butane per 1,000 cu. ft. of feed gas. (Recovery of this natural product becomes economical only as an incremental operation of the Hydrocol process.)
2. The separation of 40,000,000 cu. ft. per day of high-purity oxygen from air.
3. The partial combustion of 64,000,000 cu. ft. per day of natural gas with the high-purity oxygen to produce a mixture of carbon monoxide and hydrogen.
4. The conversion of this mixture of carbon monoxide and hydrogen—called Hydrocol gas—into gasoline and other synthetic products.
5. The separation of the gasoline and other synthetic products by fractionation and absorption techniques.
6. Treatment of the gasoline to remove oxygenated compounds, polymerization of the propylene and butylene, rerunning, blending, etc.
7. The manufacture and revivification of catalysts.

The Carthage Hydrocol plant is scheduled to be in operation late in 1947 and will cost an estimated $15,000,000. Allowing credit for the diesel oil at 3½ cents per gallon and for the crude alcohols at ½ cent per pound, it is predicted that the "out-of-pocket" cost of the gasoline will run about 2½ cents per gallon. This cost includes all expenses and charges exclusive of capital costs. When capital costs, including interests, depreciation and amortization, are added, the cost of the gasoline becomes 5.25 cent per gallon. This figure compares favorably with figures for producing gasoline of similar quality from crude oil at today's crude prices. Discounting any advantages which would result from a probable increase in the price of crude, it is obvious that the most fruitful avenue for improvement in the economics of the process is in the reduction of capital cost. Substantial reductions in the cost of future Hydrocol plants seem probable.

History of the Process

With this picture of the projected plant in mind, it is interesting to review the history of the process. Twenty-five years ago two Germans, Frans Fischer and Hans Tropsch, discovered a process for the synthesis of gasoline and oil from "water-gas"—i.e., a mixture of carbon monoxide and hydrogen prepared by blasting incandescent coke with steam. This so-called Fischer-Tropsch method was developed to the point of commercialization under government subsidy in that country about 10 years ago. While it would have been uneconomic in the United States, it received favor in middle Europe due to the almost complete lack of petroleum and to the resulting artificial economy.

American engineers first became seriously interested in synthetic gasoline shortly before the recent war. A survey of the German work led to the conclusion that the Fischer-Tropsch installations, while highly developed from a chemical standpoint, was basically lacking in engineering design. It appeared that the application of modern chemical engineering practice, as typified by the process installations of the petroleum industry in this country, might very well make it possible to build a plant which would hold its own in an open market.

In reviewing the history of synthetic gasoline, it is convenient to treat separately (1) the manufacture of the carbon monoxide and hydrogen mixture, and (2) the reaction of this mixture to produce gasoline and other hydrocarbons.

Hydrocol Gas

The manufacture of carbon monoxide and hydrogen mixtures by the "water-gas" reaction is an old and familiar process. It will be recognized immediately as the basis for the production of "city gas." The first commercial Fischer-Tropsch plant in Germany, built by Ruhrchemie A.G., made use of this reaction to produce the necessary ingredients for synthetic gasoline. Prior to this application, however, I. G. Farbenindustrie A. G. had had occasion to produce mixtures of carbon monoxide and hydrogen, at first for the manufacture of ammonia and later for the manufacture of methanol and synthetic oil. Since I.G. did not have access to sufficient reserves of coking coal, they were forced to adapt the process to "Braunkohle," a superior species of peat slightly lower in rank than bituminous coal. Consequently, they developed a method for producing suitable carbon monoxide-hydrogen mixtures by burning Braunkohle with steam and oxygen. The I.G. process, as finally developed in the middle and late thirties, became a reality when a mechanically sound generator was designed and an economic method of producing oxygen was developed.

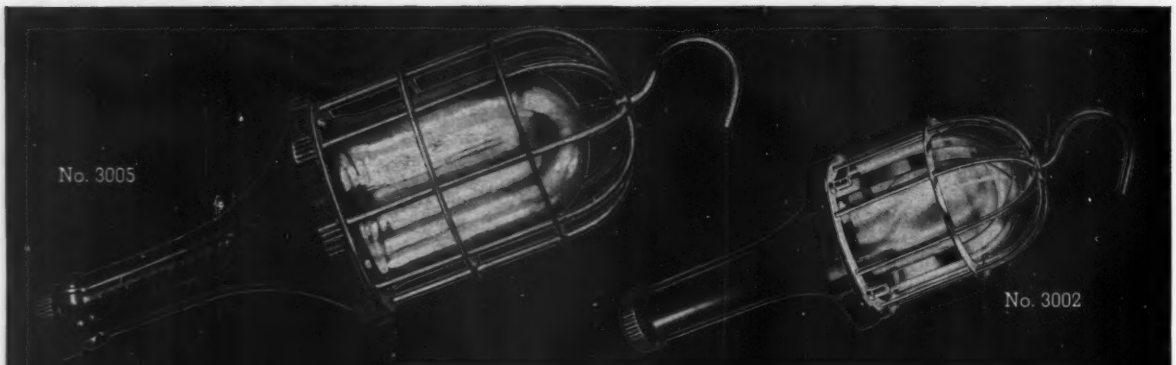
The generator, known to the trade as the "Winkler" generator, looks very much like a squat blast furnace. Into an opening in one side there is fed crushed Braunkohle. Through tuyeres around the periphery near the bottom a preheated mixture of oxygen and steam is introduced at high velocity. This gas passes up through a grate, suspending the Braunkohle in the form of a "boiling bed" above the grate. It is interesting to note that this principle of suspending a powdered solid in a high-velocity gas

THE AUTHOR

P. C. Keith, a native of Sherman, Tex., was educated in the public schools of Sherman, at Austin College, Austin, and at Massachusetts Institute of Technology where he did special graduate work for 3 years. Early in his career he worked for the Texas Co., Universal Oil Products Co., and Kansas City Testing Laboratories. For many years he was vice president of M. W. Kellogg Co., in charge of engineering, processing, and research work.

During the period immediately preceding this country's entry into World War 2, Keith was active in the design and engineering of plants for aviation gasoline, toluene, butadiene, synthetic ammonia, magnesium metal, and separation of oxygen from air. With the declaration of war, he was appointed to the Planning Board of S-1 Section of the Office of Scientific Research and Development, and for the next 3½ years devoted his energies to the development of atomic power. During the early months of 1942, he directed the development of the diffusion process under the sponsorship of OSRD. Later, as vice president and technical director of Kellex Corp., he was responsible for all research and development, process design, engineering, procurement of materials, and supervision of plant construction for the Oak Ridge gas diffusion project. Now, as president of Hydrocarbon Research, Inc., Keith is busy putting the final touches on a process for the conversion of natural gas to 88-octane gasoline and completing arrangements for the construction during the coming year of a full-scale plant to carry out this process.

The accompanying paper was presented orally by Keith at the annual meeting of the Natural Gas Department of the American Gas Association at Cincinnati, May 7-8, and has just been released.



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- WATERPROOF
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- PORTABLE
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- RUBBER SEALED
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Designed with heavy Brass cage to prevent sparks, McGill Vaporproof guards are airtight, water and moisture proof. These guards are grounded as an additional safety feature making them 100% safe for any and all your portable lighting needs. Ask for literature.

McGILL MANUFACTURING COMPANY, INC. *Electrical Division* VALPARAISO, INDIANA

Oil exploration far out in the waters of the Gulf of Mexico (discussed on Page 98 of this issue).

PUMPS

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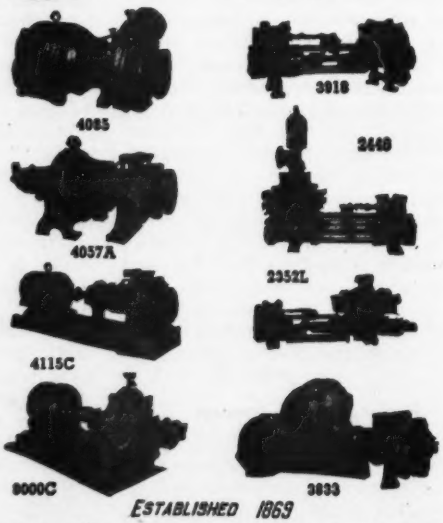

ESTABLISHED 1869

DEAN BROTHERS PUMPS INC.
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stream is also the basis of the fluid catalyst bed, a technique which is finding greater and greater application in petroleum refining and in the chemical industry as a whole. By burning the Braunkohle in the presence of oxygen and steam, temperatures up to 2,500° F. are attained in the generator, with the result that the contained hydrocarbons are distilled and cracked, and essentially all the whole mass, except the moisture and ash, is converted to a mixture of carbon monoxide and hydrogen.

The oxygen, 58 per cent pure, was produced by the Linde-Frankl process. This method involves compressing and liquefying air and then separating the oxygen from the nitrogen by fractionation. In the Linde-Frankl process, moisture or carbon dioxide is eliminated from the air mechanically rather than by chemical treatment. Much of the economy derives from the fact that upwards of 96 per cent of the feed air needs only to be compressed to about 75 psi. The plant is continuous and extremely simple in operation. In 1938, I.G. were producing millions of cubic feet per day of oxygen by this method.

With natural gas as the starting material in place of coal or Braunkohle, the natural gas can be converted either by direct burning in oxygen or by reaction with steam in an indirectly fired retort. The latter method is the familiar steam-methane process used in the synthetic ammonia and synthetic methanol processes. The steam-methane process requires a prohibitively high capital cost as well as an excessive consumption of methane. It was, in fact, the realization that cheap oxygen and direct burning of the natural gas afforded the only economic method of producing the carbon monoxide and hydrogen mixture required for synthesis that led Hydrocarbon Research to spend so much effort and money performing the oxygen plant and the direct combustion method.

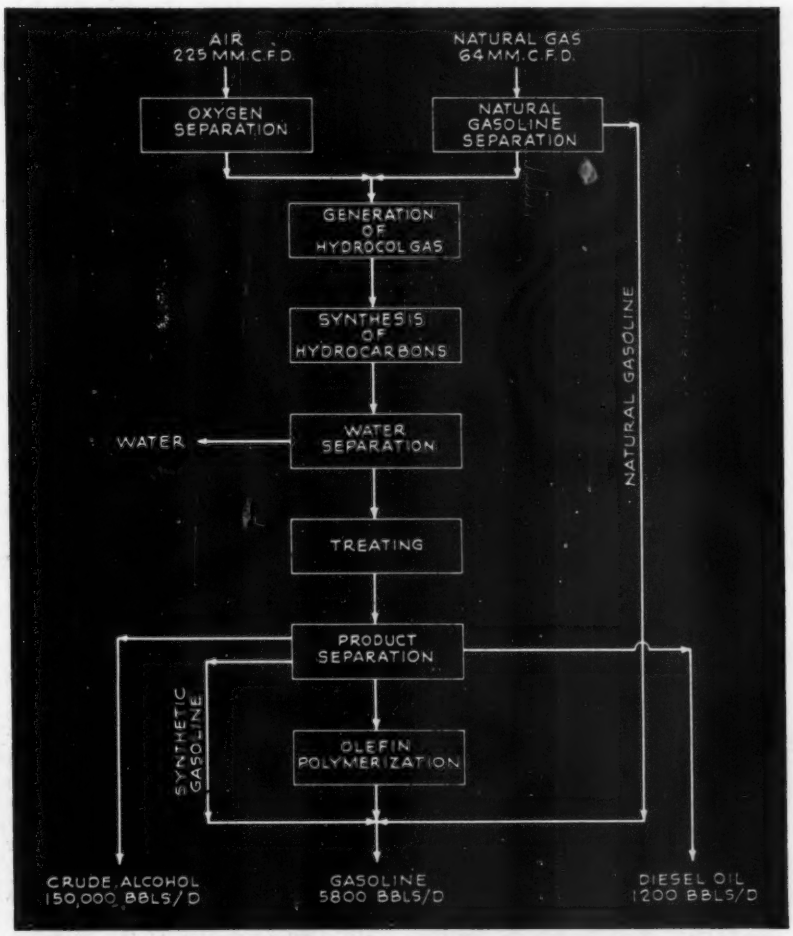
In the Hydrocol plant to be erected at Brownsville, preheated natural gas and oxygen will be reacted at 250 lb. pressure in the generator to produce the carbon monoxide and hydrogen mixture known as Hydrocol gas. Experimentation at Olean, N. Y., in a 10-bbl.-per-day semicommercial plant, and on a larger scale at Montebello, Calif., has shown that the reaction goes smoothly and controllably. Operating at this pressure is advantageous because it eliminates the necessity for inserting a compressor station between the generator and the synthesis reactor. Since the natural gas will be available under pressure, the only requirement is to compress the oxygen prior to mixing it with the natural gas in the generator. Although the reaction takes place at relatively high temperature, the metal shell temperature can be maintained safely within accepted working limits by the proper selection of insulating materials and the introduction of vapor stops.

It is of interest that the oxygen unit of the Brownsville plant will be the largest ever built. Compressing air to 75 lb., it will produce 40,000,000 cu. ft. per day of oxygen at an estimated cost of 4.8 cents per 1,000 cu. ft. This figure is based on investment of $3,500,000 for the plant (including construction labor, materials, etc.) amortization at 12½ per cent per year, maintenance at 4 per cent per annum, and two operators per shift. Power (amounting to less than 14 kw. per 1,000 cu. ft. of oxygen) and water costs are excluded, since they are both available as byproducts of the process and are automatically covered in the price paid for natural gas.

As will be developed later, this oxygen development should be of real interest to the gas industry since it promises not only to materially lessen the cost of making "city gas" but to open up the possibility of completely gasifying coal and producing therefrom a 1,000 B.t.u. pipe-line gas.

The catalytic reduction of carbon monoxide with hydrogen to produce hydrocarbons has been known since 1902 when Sabatier, the great French experimentalist, synthesized methane over cobalt and nickel catalysts at 400°-600° F. In 1912 the B.A.S.F. (Badische Anilin und Soda Fabrik, later I.G.) in Germany discovered that hydrogens higher than methane were formed in small amounts when carbon monoxide and hydrogen were reacted over an alkali-promoted iron catalyst at temperatures of 775°-850° F. and pressure of 100-150 atm. However, the desired product of the reaction was Synthol, a mixture of alcohols, aldehydes, fatty acids, esters, and other oxygenated organic compounds. This led eventually to I.G.'s synthetic methanol process, but as late as 1921, they were reporting the elimination of "objectionable" oil as one of their chief problems.

In 1923, Franz Fischer and Hans Tropsch discovered that the hydrocarbon yield could be greatly increased at the expense of Synthol by decreasing the pressure. In fact, at pressures less than 7 atm., the product was mainly aliphatic hydrocarbons. This work formed the foundation for the Fischer-Tropsch process, which was responsible for the



Schematic diagram of the Hydrocol process

production of a large quantity of synthetic fuels in Germany during the recent war years.

Working under the auspices of the Ruhrchemie A.G., Fischer and his associates examined hundreds of catalysts and finally concluded that cobalt, nickel, iron, and ruthenium constituted the most active metals and that thoria and the oxides of other rare earths were good promoters. It was further shown that the presence of some alkali was desirable and that kieselguhr was the best support or carrier of the active ingredients.

By 1933 the process was considered to be well enough developed to build a commercial unit. Accordingly, Ruhrchemie constructed a plant at Oberhausen-Holten with a rated capacity of 1,000 metric tons per year (about 8,000 42-gal. bbl.) of motor fuel and lubricating oil. The first catalyst used was a nickel-manganese-aluminum oxide mixture on kieselguhr; this was later supplanted by a cobalt-thoria-kieselguhr preparation. This plant, as the others which followed it, had many shortcomings which could be tolerated only under a structure supported by government subsidy. Among these were:

Early Shortcomings

1. The initial cost of the catalyst was high and reworking was expensive.

2. The catalyst was extremely sensitive and had to be broken in very slowly according to a rigorous schedule.

3. The catalyst was rapidly poisoned by small traces of sulfur.

4. Catalyst life was limited to 6-8 weeks, due in part to accumulation of high-melting-point waxes on the surface.

5. Conversion of carbon monoxide to useful products was only about 40 per cent of the theoretical, despite the use of low space velocities (maximum of 100 volumes of carbon monoxide per hour per volume of catalyst).

6. The yield of oil per unit of catalyst per unit of time was low, due to the low space velocity, which in turn was limited by the capacity for removal of the heat of reaction.

7. The reactors were complicated, extended surface exchangers, with cooling surfaces no farther than 12-15 mm. from any part of the catalyst. Since the process was operated at atmospheric pressure, the reactors were necessarily large.

8. Recovery of heat of reaction as useful power was low.

9. The gasoline produced had an octane number of about 40, too low to permit its use as a motor fuel without additional treatment.

From a detailed study of German designs and operating data, it became clear that the only way to lower the costs of the process was to improve its efficiency. This involved finding both a cheaper and more efficient means of heat transfer and a catalyst that would operate at a higher velocity, the catalyst and the reactor design being interdependent.

For example, if the catalyst temperature must be controlled within 25° F. to maintain activity and product distribution, a minimum quantity of cooling surface must be provided on the basis of a reasonable transfer rate. This in turn fixes the maximum space velocity allowable, assuming that the catalyst activity is not limiting. For example, the heat liberation for 90 per cent reaction of 1 cu. ft. of synthesis gas is about 55 B.t.u.; at a space velocity of 100 the hourly duty would be 5,500 B.t.u. per cubic foot of catalyst space. With a transfer rate of 10 B.t.u./sq. ft./hr./°F. and a mean temperature difference of 10° F., the cooling surface required would be 55 sq. ft. These conditions approximate the best design of Ruhrchemie.

It is immediately obvious, then, why space velocity in such a reactor as the Ruhrchemie design is definitely limited. Raising it will increase the heat load, and hence the temperature, so that either product distribution will suffer (i.e., fixed gas production will increase) or the catalyst will become fouled with coke. Also, under ideal conditions in such a system, localized hot spots can still occur. In fact, there is experimental evidence that the true catalyst temperature in a fixed-bed system is at least 75°-100° F. higher than the observed gas temperatures and that at isolated points it is much higher.

There can be no question that catalyst activity has seldom been the limiting factor. More often it has been the efficiency of removal of the heat of reaction. In other words, with adequate heat removal, the space-time yield of oil is potentially much greater than anything that has ever been realized. It was on the basis of this conclusion that engineers of Hydrocarbon Research suggested a program of experimental work in which the space-time yield of oil would be studied as a function of space velocity and cooling surface.

In reviewing the work done by Ruhrchemie and I. G., it became apparent that one possible way of improving markedly the space-time yield of oil was to use the fluid or powdered catalyst technique. With the fluid process, it will be recalled, the catalyst is ground to a very fine powder (approximately 75-80 per cent finer than 325 mesh) and is then maintained in a state of turbulence by aeration with regulated quantities of gas. When the powder is properly prepared, it can be aerated or partially suspended by the gas and assumes many of the properties of a boiling liquid. For exaxmple, there is a constant motion of the particles, and while the surface of the bed of powder is reasonably fixed, local eruption of bubbles are evident. Furthermore, the powder flows freely, exerts a static head and is compressible.

Among the advantages of the fluid catalyst technique are: (1) temperatures can be controlled within 5°-10° F.; (2) the catalyst itself is utilized as a medium of heat transfer; and (3) processes using the fluid catalyst are continuous, since any decline in activity can be compensated by withdrawal of a portion of the catalyst and replacement with fresh material.

Before embarking on a program of experimental work to determine the feasibility of the fluid catalyst technique for the synthesis reaction, it was concluded that the use of a cobalt catalyst was impractical because of the high cost, the limited amount of cobalt available, and the low-octane number of gasoline. Accordingly, attention was directed to cheap, rugged, iron catalysts.

Experimental Work

The Hydrocol plant to be erected at Brownsville has back of it over $1,000,000 of experimentation carried on at Hydrocarbon's experimental station at Olean. The 10-bbl.-per-day semicommercial plant built and operated at the experimental station contains all the elements of a commercial plant:

(1) A continuously operated low-pressure oxygen plant with a capacity of approximately 10,000 cu. ft. of oxygen per hour.

(2) Pressure generators for the burning of natural gas with oxygen to produce Hydrocol gas.

(3) The synthesis reaction system.

(4) A product recovery system.

(5) Facilities for deoxygenating the gasoline produced.

Hydrocarbon Research, Inc., started its development work convinced that the Fischer-Tropsch process was fundamentally sound but was woefully lacking in good engineering design. It seemed obvious that the application of modern chemical engineering practice, as typified by the process installations of the petroleum industry in this country, would result in marked improvements in efficiency. In fact, it appeared probable that such engineering improvements would make the process economic in the United States, using natural gas as the immediate raw material.

The principal conclusions from the research and development work were:

(1) The oxygen plant design is sound and oxygen can be produced by the hydrocarbon cycle efficiently and at relatively low cost.

(2) Natural gas can be burned directly with oxygen to produce Hydrocol gas. The operation is controllable and the product gas is free of soot.

(3) The fluid catalyst technique

more than confirmed expectations with regard to heat control, and is certainly the most economic method of operating the process.

(4) The exothermic heat of the reaction is almost totally recoverable in the form of high-pressure steam. The Carthage plant will produce upwards of 750,000 lb. per hour of high-pressure byproduct steam.

(5) Conversions of Hydrocol gas of better than 90 per cent are obtainable with a cheap, rugged catalyst.

(6) The yield of oil, based on carbon monoxide reacted, is higher than that obtained by any German investigation, and the treated gasoline is of a premium quality.

(7) The allowable space velocities, and hence the space-time yields, are order of magnitude greater than any achieved in Germany.

(8) The yield of gasoline can be readily controlled to constitute better than 80 per cent of the total useful products.

(9) There are no real difficulties or novel methods required in separating the products or in deoxygenating the gasoline.

Three Companies Involved

The initial million-dollar research and development program carried on by Hydrocarbon Research was financed by three companies: LaGloria Corp., J. S. Abercrombie Co., and Socony-Vacuum Oil Co., Inc. Later material development and engineering contributions were made by Standard Oil Co. of New Jersey and by The Texas Co. The country as a whole should recognize the role these companies have played in furthering the development of cheap synthetic gasoline in the United States.

The successful operation of the plant at Brownsville could have far-reaching effects upon our national economy. These effects are most likely to be first felt in the oil industry. The feasibility of producing large quantities of a superior motor fuel from a portion of our "known" dry gas reserves will have been demonstrated. Since these reserves amount to about 175 trillion cubic feet, potentially they represent about as much oil as do our crude oil reserves.

In other words, when the Brownsville plant has operated successfully and economically over a period of time, it would then be proper to reckon our oil reserves at, say, 40 billion barrels. Then natural gas will begin to compete with crude oil as a raw material from which to produce refined products. What effect this competition will have upon advancing crude oil prices is anybody's guess. The author's is that it will be a ceiling of less than $2 per barrel on crude oil.

An obvious corollary to the above has to do with gas conservation. Sometimes it is difficult to legislate conservation, but when conservation is clearly and immediately profitable, no legislation is needed. Despite the conservation measures now enforced by various state regulatory bodies, gas wastage still amounts to about 600 billion cubic feet per year. The major source of this loss occurs in gas vented from oil-gas separators at the fields and from natural-gasoline plants.

The successful operation of the Brownsville plant will place a portion of this gas in the category of a substitute for crude oil. If it were used for such a purpose, some 60,000,000 bbl. per year of oil would result. The problem of collecting the gas in large quantities will prevent the use of the entire amount, but some of it will be used, and to the extent it is used, true and real conservation will have been practiced.

Further, the Brownsville plant will indicate a method whereby gas now used as refinery fuel can be converted into gasoline. Again, if all such gas were used for gasoline synthesis, the amount produced would approximate 7½ per cent of our 1945 production. Obviously, all will never be used, but some refineries will use it, substituting heavy bunkering oil for gas as refinery fuel. And this will lead to an advance in oil prices.

So much for the immediately foreseeable effects upon the oil industry. But how does this development directly and indirectly affect the gas industry? The effects could be fundamental and far reaching. Firstly, the competition of natural gas with crude as a source of gasoline is certain to increase the price of gas at the well head. In the next several years, improvements in the Hydrocol process will make possible the production of a barrel of oil from 8,000 cu. ft. of gas, including all gas used for fuel. If at that time the capital and operating cost of a Hydrocol plant is on a par with an oil refinery (and there is no basic reason why this cannot become true), then 8,000 cu. ft. of gas at the refinery will be the equivalent of a barrel of 38° A.P.I. gravity Mid-Continent crude. Then, under these conditions, gas at 17 cents per thousand just balances crude oil at $1.35 per barrel; both prices as delivered to the refinery.

It is the author's guess that gas in such localities as Hugoton, East Texas, and the Gulf Coast will never quite reach the equivalent price of crude oil. In the first place, gas transportation is inherently more expensive than the transportation of crude oil. Secondly, gas must always be transported by gas pipe line and not by tanker or tank cars. Therefore its mobility is limited. Thirdly, the effect which the actuality of cheap oxygen will have upon manufactured-gas costs will tend to limit the competitive value of natural gas for pipe lines. Nevertheless, gas prices will go up. It is not unlikely that, in the localities just mentioned, gas at the well head will be worth 10-12 cents within the next decade.

It was stated above that cheap oxygen will tend to limit the price of natural gas in such localities as Kansas and Texas. It will be recalled that the Germans completely gasified "Braunkohle" continuously, successfully and economically. It appears that improvements, comparable in magnitude to those made in the Fischer-Tropsch process, can be made in the gasification of coal.

It has long been the ambition of the manufactured-gas industry to produce city gas directly from coal and oxygen. Compared with the present intermittent methods, the direct gasification process would be more thermally efficient, would eliminate the use of expensive gas oil, and could be continuous. Hydrocarbon Research, Inc., has such a process in an advanced stage of development. A small pilot plant has been built and successfully operated in which both coking and noncoking coals are distilled and partially gasified with oxygen. The gas as run from the pilot plant has had calorific values higher than required for city gas. Freed of carbon dioxide, the heating value of the gas has varied from 580 to 900 B.t.u. per cubic foot according to the extent of gasification of the coal.

"Guesstimates" of Cost

Based upon these preliminary data and again applying advanced oil-refinery techniques to the process design, "guesstimates" have been made which indicate that in such localities as New York, city gas can be made from bituminous coal at a cost less than the cost of natural gas purchased at the wells in Texas for 5 cents per 1,000 cu. ft. and transported to the East Coast by pipe line. Also, the estimated cost of gas by the direct gasification process is much lower than the present cost of gas manufactured by the larger utility companies.

These studies posed the further question: "Why haul coal to New York and then gasify it? Why not gasify it at the mine mouth?" Hence, a careful, thorough, and intensive survey was made of all German processes. These were evaluated in the light of the data gathered from Hydrocarbon's own experimental work. Then a hypothetical plant was designed. From this preliminary work, it appears certain that eventually a process will be developed whereby either coking or noncoking bituminous or anthracite coal can be completely gasified, yielding a pipe-line gas of approximately 1,000 B.t.u. heating value. These preliminary studies further indicate that the net thermal efficiency—i.e., the ratio of

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the heating value of the product to the heating value of the coal, including all coal used as fuel—will be about 80 per cent. In other words, it is to be expected that 1 ton of 13,000-B.t.u./lb. coal will yield 20,000 cu. ft. of synthetic gas.

Hydrocarbon Research is presently building a semicommercial plant to produce directly, continuously and with oxygen both "city gas" and "pipe-line gas." It is hoped the plant will be in operation this year and quantitative design data will be available next year. Expectations for the process are based in part upon the data gathered during the course of development of the Hydrocol process, and if they are realized, one can visualize gas-pipe-line companies serving the north and northeast manufacturing "synthetic" natural gas from coal mined in West Virginia, Illinois, and Pennsylvania. Obviously, this development of the direct gasification process will tend to place a ceiling on the price of natural gas.

We have now seen how the Hydrocol process is likely to affect both the price of crude oil and the price of natural gas, placing a ceiling over the former and raising the latter. We have also seen how the development of a direct gasification process will tend to place a ceiling over the price of both natural gas and manufactured gas. A further factor to be reckoned with in our future economy is the approaching coal-to-gasoline process. An economic process for transforming coal into gasoline will put a ceiling over the price of crude oil even more effectively than the Hydrocol process. Also, it may well increase the value of some of our low grade coal deposits. However, the amount of coal required to satisfy our entire gasoline market will always be small in comparison to the coal used for other purposes, and so the effect on the country's coal economy as a whole can never be great.

"Approaching coal - to - gasoline process" is said, for we are now well on our way to gasifying coal cheaply, and the combination of the direct gasification process and the Hydrocol process is the coal-to-gasoline process. In fact, on the basis of figures now available, 6-cent gasoline from $2-per-ton coal is not more than 2 or 3 years off.

In summary, the successful development of the processes just reviewed will (1) assure this country of an adequate supply of cheap gasoline, city gas, and petroleum products for centuries to come; (2) make available cheap oxygen for use in the chemical and metallurgical industries as well as in the gasoline and gas industries; and (3) provide cheap raw materials, particularly carbon monoxide, hydrogen and oxygenated hydrocarbons, to serve as the basis of a great new synthetic-chemicals industry.

PROGRESS IN METALS

by W. L. Nelson
Consulting Engineer

Spot Tests for Aluminum And Magnesium Alloys

THE U. S. Navy is operating a number of salvage plants throughout the country. The recommended chemical spot tests for aluminum or magnesium alloys are:

Aluminum

1. **Caustic soda.**—Apply a drop of 20 per cent caustic-soda solution to the cleaned surface of the metal and allow to react for 5 minutes. Remove the surplus liquid with blotting paper and observe the resultant stain.

(a) White stain indicates pure aluminum or aluminum-manganese alloy.

(b) Grey-brown stain indicates a high silicon-aluminum alloy.

(c) Black stain indicates either dural or other aluminum-copper alloy.

2. **30 Per cent nitric acid.**—Add one drop of nitric acid to any colored stain produced by a caustic-soda solution. If complete solution of the stain does not take place a relatively high silicon content is indicated.

3. **50 Per cent ammonia solution.**—Add two drops of 50 per cent ammonia solution to the drop of acid, whatever may have been the action of the latter on the original stain—a blue color formation will indicate the presence of copper in alloying quantities.

4. **1 Per cent alcoholic solution of dimethylglyoxime.**—Finally, add one drop of a 1 per cent alcoholic solution of dimethylglyoxime to the wetted area. A brilliant red color spreading over the spot indicates alloying quantities of nickel.

5. **Cadmium sulfate solution.**—One drop of cadmium sulfate solution applied to a freshly cleaned surface will result in a dark gray spongy deposit immediately with alloys containing approximately 10 per cent zinc. A light gray deposit indicates an alloy containing approximately 5 per cent zinc.

Magnesium

The only positive method of identifying magnesium alloys is by a chemical spot test. Place a single drop of the following solution on a small freshly filed surface:

Cadmium sulfate	50 gm.
Sodium chloride	100 gm.
Hydrochloric acid	400 gm.
Water	800 gm.

A violent effervescence immediately followed by a black deposit formation indicates magnesium.

Ten per cent nitric acid in water (alternate test): This solution will attack magnesium but an aluminum alloy will not be attacked.

Lubricants for Drawing Magnesium

MANY of the difficulties in drawing magnesium are tied up with the brittleness of the close-packed hexagonal crystalline form. As the temperature of the metal is raised, however, the deformation properties of the metal are greatly improved and at temperatures of 450° to 700° F. the metal may be more severely worked than can most other metals at room temperature. Temperatures above 750° F. should be avoided.

This situation, which makes hot forming of magnesium necessary, results in basic differences in lubrication problems from those encountered in cold forming of other metals.

Desirable properties of a lubricant for drawing magnesium are: (1) Ease of application, (2) good lubricating qualities, (3) ability to withstand temperatures up to 700° F., (4) chemical inertness, (5) quality of burning off without leaving a residue that is difficult to remove, and (6) lack of toxicity.

Most widely used component of lubricants for drawing magnesium is graphite, because of the resistance of this material to high temperatures and its innate lubricating qualities. Dow Chemical Co. engineers have found colloidal graphite suspended in a volatile solvent to be very good. This is sprayed on the sheet with a conventional spray gun. Acheson colloidal graphite Type 2404 for sheet (used in the proportion of one part to 50 parts of carbon tetrachloride) also can be employed.

Another method of using graphite is with a suspension of 20 per cent flake graphite in tallow or in tallow-and-mineral-oil mixture. In this case, it is suggested that this be applied by buffing on die surfaces rather than to the work. Flake graphite in a volatile solvent has also been suggested.

In using graphite it is desirable to clean the die occasionally and to rub some graphitized grease on the working surfaces by means of an asbestos pad.

It is very important to clean the work as soon as possible after using graphite lubricants. In general, Dow suggests use of oiled rather than chromium pickled surfaces if graphite is used since cleaning is facilitated.

Other suggested lubricants include a mixture of high-flash-point oil consisting of asphaltic still residue and black oil, with 0.75 lb. of mica per gallon; Lennox soap solution and a good brand of heavy machine oil for use on the dies.

Many workers suggest the use of mild steel for tools rather than hardened steel. It is important to maintain a high polish on the tools.

Punches for drawing magnesium are made of steel, aluminum, cast iron, zinc, and even magnesium alloys.

Abstract of paper by Samuel Spring in Steel Vol. 117, Dec. 31, 1945, p. 64, taken from Materials and Methods, March 1946.

Atomic Age Is Metal Age

ORDINARILY the words "metal" or "metal industry" bring to mind operations of mining, ore reduction, or the physical fabrication of metals or alloys. Nevertheless, metals may be used for many other purposes than structural ones, now even in the direct generation of atomic power. In this sense, metals or at least uranium 235 is a fuel. The debris of the fission of uranium consists to a large extent of heretofore rare metallic elements. They may not be so rare in the future or who knows what basic metals may be converted on a bulk scale into more useful ones by means of atomic transformations. As only one example, if iron could be converted into nickel a whole new field of high-temperature alloys would be developed, alloys which could withstand the temperatures of 1,300°-2,000° F. required for the development of gas turbines and rocket-type engines.

In a more prosaic way, metallic materials will always be useful because of their high strength, hardness, and toughness. The atomic age will be insatiable in its appetite for metallic materials. With the unfolding of the atomic age will come a demand for all kinds of materials, particularly such high-grade materials as metals. Metals will be cloth in which atomic energy is clothed, the harness by which it labors.

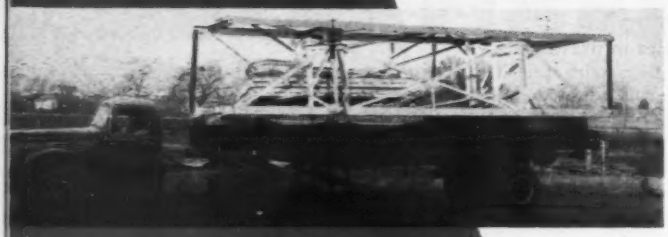
The least that can be said is that we are on the brink of strange and enormous developments which lead no one knows where.

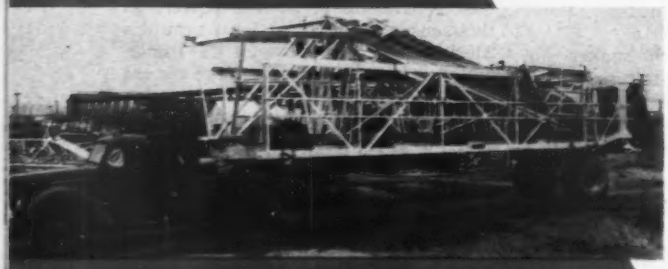
Metallurgical Terms

Mechanical Working

Working metal through rolls, presses, hammers, etc., to change its shape, properties, or structure, is called mechanical working. If conducted at room temperature the working is called cold work, whereas if the work is conducted at the elevated temperature of the critical region of the iron-carbon diagram it is called hot work.

It's Easier to— TRANSPORT ERECT and DRILL with a





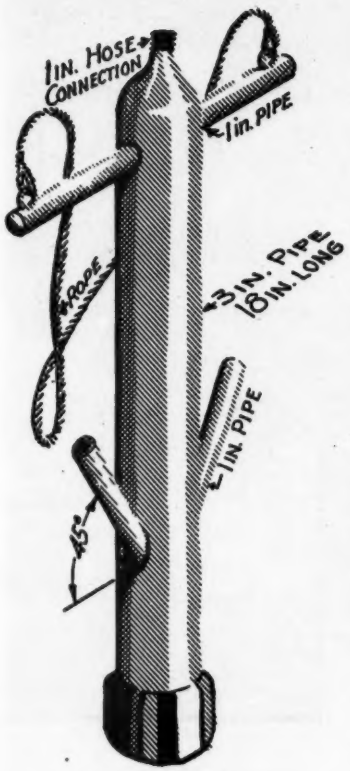
The patented Moore Jackknife Cantilever Rotary Drilling Mast is designed to minimize the time required to Dismantle, Transport and Erect.

Moore Masts are available in heights of:
87′ capacity 300,000 lbs., 95′ capacity 360,000 lbs.,
98′ capacity 450,000 lbs., 127′ capacity 450,000 lbs.,
129′ capacity 450,000 lbs., 136′ capacity 720,000 lbs.

The 87′, 95′ and 98′ masts including skid base, crown block and racking platform can be transported on two trailer trucks. Three trucks are required to transport the 127′ mast. The 129′ and 136′ masts, which are furnished with a large sub-structure, require four trucks.

Once on location all assembling and stringing-up is done on the ground. Approximately 2 minutes are required to raise the mast from the horizontal to the final operating position. The gin pole is an integral part of the mast; no guy lines are required.

PLANT PRACTICES

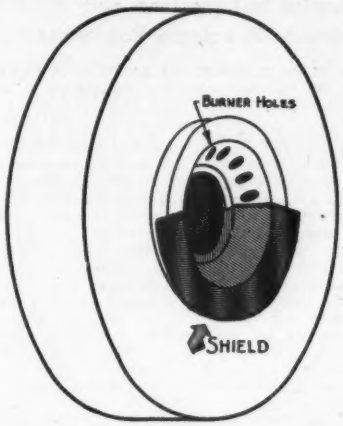


Tank Cooling Air Manifold

COOLING a tank, tank car, or other container which has been steamed to drive out vapors may be accomplished by attaching to the end of an air-connection hose a spray nozzle shown in the drawing. A section of pipe of the desired size and length, say, 3 in. in diameter and 16 in. long, or smaller or larger as desired or according to the size of the container to be aerated, is closed at one end by welding, cap, etc. Two smaller 3-in. long nozzles are welded into holes cut in the pipe section, at 45° angles, the outer ends open. A bumper may be placed on the lower end of the main pipe section, such as a composition or hard-rubber cap or ball, to rest on the bottom of the tank. This arrangement produces a circulatory air motion. The apparatus may be raised and lowered by attaching an 18-in. bar at the top of the main pipe section out of the way of the threaded air-hose connection placed in the end of the main pipe section, and a rope or cable attached to the bar ends by eye bolts welded on. The rope is arranged in the required length for lowering the apparatus from the dome of a tank car, for example, and tying the aerator header in an upright position in the bottom of the tank. *(Idea submitted by J. R. Rucker, rack foreman).*

Shield to Protect Burners When Not in Service

A SHIELD which will prevent damage to or plugging of burner when repairing furnace and which will avoid need for removing burner at such times to prevent these troubles is shown in the accompanying drawing. A sheet of light-gage steel is cut and bent to the form shown. As soon



as the furnace is "down" and is entered, the shield is hung over the lower portion of the burner so as to cover the holes in that part completely. If desired a shield may be cut to cover all the burner holes, it being hung from any convenient projection. *(Idea submitted by G. W. Morris, repairman foreman).*

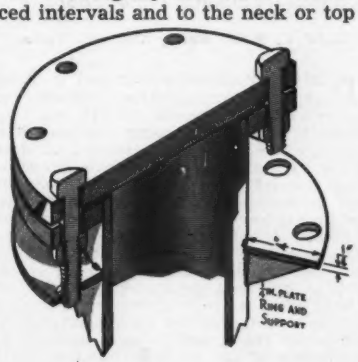
Valve Trouble Indicator For Compressors

ONE cause of troubles in multicylinder compressor operation is that of broken or leaking valves in the high-pressure cylinder permitting high-pressure to back up against the low-pressure cylinders, causing bad operation, overloading the low-pressure stage, missing ignition, and even going so far as to stop the compressor. A solution for this difficulty is

the installation of a pressure gage in the transfer discharge from low to high stage which will indicate the pressure at all times. When this gage shows a mounting and too-high pressure on the transfer line it is traceable to a broken or leaky valve in the high-pressure cylinder. Replacement of the valve with a good one will save many times its cost each year. *(Idea submitted by A. F. Hanneke, helper).*

Support For Soaker Head Nuts Prevents Crossthreading

CONSIDERABLE difficulty is experienced in returning nuts and bolts to place when removing a pressure-vessel head and returning it to place again. The idea presented here is applied specifically to the head of a soaking drum in a thermal-cracking unit but is applicable to any such installation. An annular plate, which may be ¼ in. thick and 4 in. wide, is drilled with holes slightly larger than the bolts on the head in question, drilled at such intervals that the bolts and nuts will coincide with these holes when the plate is in position. The plate is supported by several angle plates welded to its under side at regularly spaced intervals and to the neck or top of the soaker, drum, or other container such as a tower. A space is allowed between the upper surface of the plate and the lower edges of the bottom nuts to allow some motion there. This plate thus holds the bolts and nuts in position so they may be started in position for closure without danger of crossthreading. *(Idea submitted by M. A. Golden, pipefitter.)*



These suggestions were submitted in the "Coin Your Ideas" program conducted by Humble Oil & Refining Co.

A.P.I. DIGESTS

Of papers presented at the meeting of the Mid-Continent Section, Production Division, American Petroleum Institute, at Oklahoma City, June 6-7

Porosity in Limestone and Dolomite Petroleum Reservoirs

WILLIAM C. IMBT and SAMUEL P. ELLISON, JR., Stanolind Oil and Gas Co., Midland, Tex.

POROSITY in limestone and dolomite reservoirs is created by primary conditions of deposition and later altered by the secondary forces of moving ground waters. Meteoric waters are probably the most important reason for the existence of limestone and dolomite reservoirs. Waters charged with carbonic or organic acids are capable of dissolving limestone and dolomite. Primary porosity may be greatly increased by solution or it may be totally destroyed by chemical precipitation. Precipitation of carbonates usually takes place below the water table where the fluids are usually alkaline and the movement of water retarded.

Plastic casts of porosity in oil reservoirs from the Permian and Devonian of West Texas, Hunton of Oklahoma, and Arbuckle of Kansas permit a geological explanation for the formation of the porosity, and demonstrate the dissolving action of acid charged waters. It is now possible through the use of plastic casts clearly to show continuity of porosity in limestone and dolomite reservoir rocks. The technique of reproducing pore spaces by plastic models was developed by R. L. Whiting and W. F. Nuss, Jr., of the research engineering department of Stanolind. Briefly, it requires that the samples to be treated be clean, dry, extracted reservoir core samples. Air is evacuated from the pore spaces and plastic forced into the openings by application of high pressure.

The plastic used is Catalin which polymerizes in 72 hours at 80° C. After polymerization has taken place, the reservoir sample is digested in hydrochloric acid to break down the carbonates and then in hydrofluoric acid to remove siliceous material. The remaining plastic model represents a faithful reproduction of the original porosity in addition to those parts of the original rock which were not attacked by either acid employed.

Repressuring in Cunningham, Kansas—Lansing Lime Pool

COLIN C. RAE, Skelly Oil Co., Tulsa.

THE Cunningham-Lansing pool in Kingman and Pratt counties, Kansas, comprises 1,400 proven acres with 53 producing wells. Pressure maintenance was started in January 1936, and has continued to date. Prior to gas input, bottom-hole pressures had declined from 1,100 to 424 psi., with the production of 1,009,000 bbl. of oil. Repressuring has resulted in the production of 2,632,200 bbl. of additional oil with a pressure decline of 59 psi. Ultimately 1,700,000 bbl. more oil than under primary methods will be produced, which represents an increase of 60 per cent. Primary oil recovery per acre-foot was 250 bbl., compared to 400 under gas input. About 84 per cent of the produced gas has been injected. For 8 years, the pool gas-oil ratio was held around 5,000 cu. ft. per bbl., during which period the gas input was into wells in the center of the pool with an oolitic lime pay zone. In 1943, gas-input wells were established in the structurally low, southwestern portion of the pool, where gas-oil ratios were very low. Considerable oil production came from a thin, highly permeable, crinoidal limestone. In this area, gas-oil ratios are now increasing rapidly. Field efforts to control the channeling are not yet successful. The results at Cunningham indicate that gas input into oolitic or limestone with medium permeability can be successful, but that pressure maintenance in thin, highly permeable lime zones may not be profitable.

Performance of Bodcaw Reservoir, Cotton Valley Field Cycling Projects; New Methods of Predicting Gas Condensate Reservoir Performance Under Cycling Operations Compared To Field Data

MARTIN G. MILLER and MAX R. LENTS, Cotton Valley Operators Committee, Cotton Valley, La.

THE Bodcaw sand Cotton Valley field cycling project was one of the first large cycling projects. Marked retrograde condensation occurred in the reservoir due to withdrawals prior to commencement of cycling operations and has since continued to a lesser degree largely as a result of processing shrinkage. Approximately 50 per cent of the wet gas reserves have been recovered with gas cycling without appreciable dilution of the wet gas with injected residue gas.

The injected gas within the reservoir has been located by means of actual well tests and was found to be contained in a definite volume within the reservoir approximately one-third larger than it should theoretically occupy. Several wells have been tested in a manner to provide dilution curves which may be construed solely as a function of the variations of permeability, porosity, interstitial water, of the producing sand. Core-analysis data have been assembled and after being properly analyzed, are used to predict dilution in a manner essentially compatible with field observation. The manner of analyzing core-analysis data is discussed and it is concluded that samples must be located with respect to their geometric occurrence and weighted for respective areas of influence.

Determination of a usable permeability profile or distribution should include: (a) A thorough investigation of the sand body, its areal distribution, and any locally significant divisions in stratification. Electric logs are indispensable for such purposes. (b) An over-all study of permeability distribution must first determine (1) whether there are any areal profile tendencies, in which case a profile for the area or the field may be determined, or (2) does the permeability of the sand at the same relative vertical location vary from well to well in a random fashion. (c) In either case, b-1 or 2, data must be weighted with respect to areas of influence after being located vertically in a manner consistent with

"Credit for this performance is ascribed by the refinery operators . . . to the faultless performance of the internal gas handling equipment which handled the gas produced. Any fault in the operation of the gas equipment, on which the catalytic cracking unit is wholly dependent, would have interrupted the operation of the Thermofor unit," World Petroleum reported.

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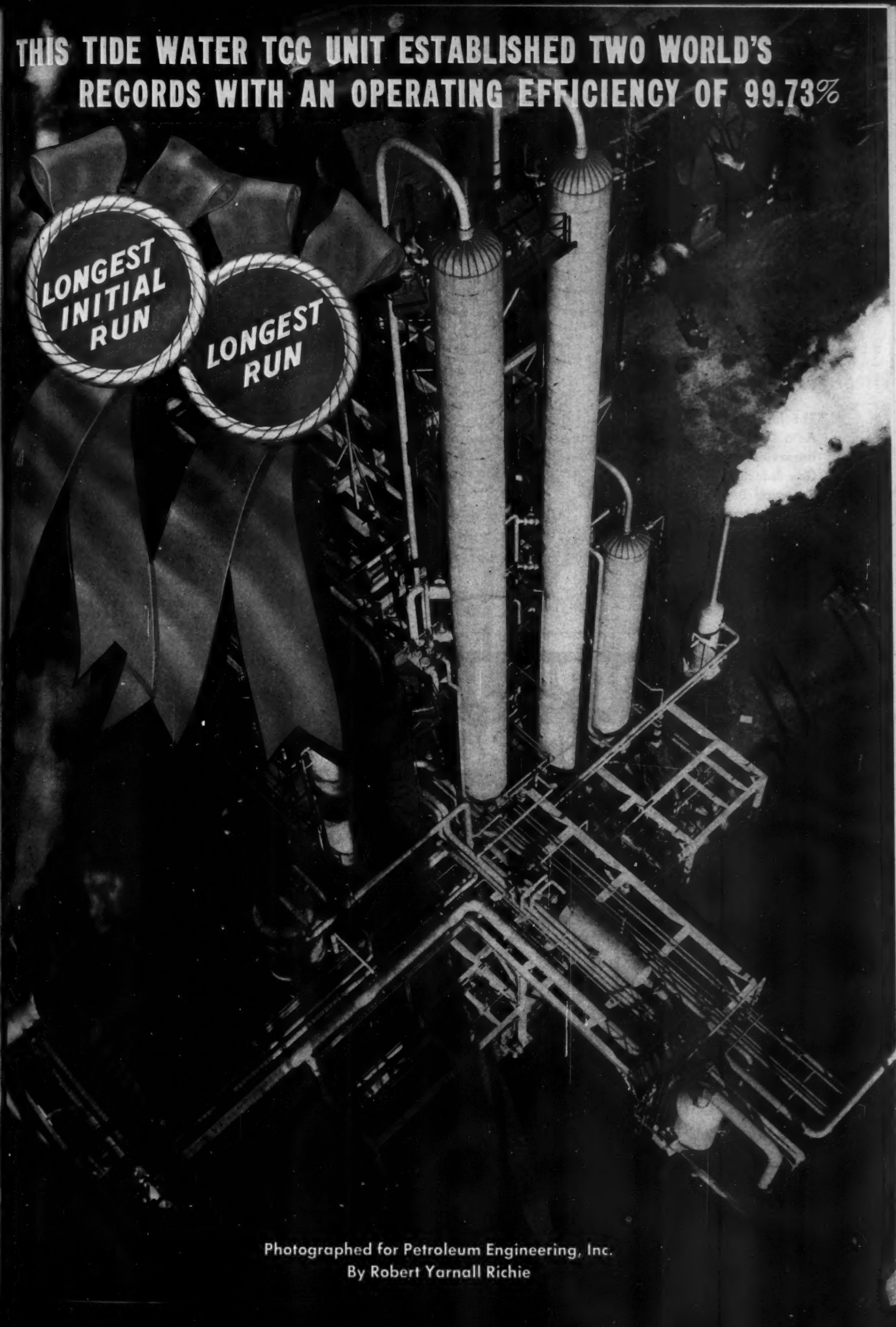

Photographed for Petroleum Engineering, Inc.
By Robert Yarnall Richie

the relative geometric occurrence of the samples. In fact, in either case it seems that the accurate vertical location of the data may be as significant as the value used. (d) Obviously any study is enhanced by a large volume of data. In fact, studies based on insufficient data may be quite misleading. (e) In general an attempt must be made to solve the geometry of the system by means of random sampling.

It presently appears economically feasible to recover 85 per cent of the wet gas reserve of the Bodcaw sand, Cotton Valley field, present at the commencement of cycling operations, by the production of approximately 115 per cent of these gas reserves.

It is concluded that, in this instance, core-analysis data when properly applied may be used to predict the dilution of wet gas with injected gas which will occur at various stages of depletion. This vital information with knowledge of the anticipated flood pattern and economics of operation becomes the basis for the calculation of the ultimate recovery of wet gas.

The Importance of Injected Gas As a Driving Medium in Limestone Reservoirs as Indicated by Recent Gas Injection Experiments and Reservoir Performance History in Typical Limestone Reservoirs

LLOYD E. ELKINS, Stanolind Oil & Gas Co., Tulsa.

THE displacement characteristics of gas in sand and limestone reservoirs are pictorially contrasted and incorporated into the scientific approach for predicting reservoir performance trends using the so-called (Kg/Ko) factor as related to stages of depletion within the reservoir.

"Apparent" (Kg/Ko) relationships are developed for seven reservoirs from actual performance data and compared with laboratory data. Conclusions are drawn that such apparent (Kg/Ko) relationships should serve as a valuable tool in scientifically determining efficient producing rates and the proper design of gas-injection programs.

The complete performance history on a prolonged gas-injection experiment is presented to show the displacement characteristics of gas in one type of limestone reservoir. Importance of controlled pressure decline through adjustment of producing rates and dispersed gas injection is evidenced by fluctuations in the apparent (Kg/Ko) relationship.

Actual predictions of reservoir performance in one reservoir brought about by different degrees of gas injection are presented to illustrate how (Kg/Ko) relationships developed from actual field performance data can be employed in predicting reservoir-performance trends for different operating conditions. In this particular reservoir it is estimated that gas injection will increase the ultimate recovery by at least 20 per cent. It is also shown that the same increase in recovery can be obtained without returning all produced gas to the reservoir.

Drilling and Coring Methods in Secondary Recovery Operations

R. B. McCLOY, Stanolind Oil & Gas Co., Tulsa.

THE author discusses the equipment and methods used for drilling and coring development wells in secondary-recovery operations. In operations of this type, holes to 1,500 ft. deep are generally drilled with spudders and deeper holes to depths of 2,800 ft. are drilled with truck-mounted rotaries or jackknife rigs; the size of equipment used being in direct relation to the depth of the hole drilled. Spudders are preferred for shallow depths due to small crews, availability of rigs and trained crews, and low initial investment; whereas, rotaries may be advantageous due to drilling speed and more satisfactory core recovery for analytical purposes. Local conditions determine the adaptability of either type equipment.

Efficiency of Illinois Water-Drive Sand Reservoirs

A. W. BAUCUM and W. D. STEINLE, The Texas Co., Tulsa.

DETAILED subsurface studies of five water-drive reservoirs in Illinois serve as a background for the information and conclusions presented. Core analyses, electrical logs, subsurface sample analyses, and production performance histories provide the basic data available for each reservoir. Well densities, rates of withdrawal, characteristics of the reservoir media, and properties of the reservoir fluids were studied to determine their effects upon recoveries.

Ultimate recoveries estimated from these pools, all of which are nearly depleted, range from 400 to 482 bbl. per acre-foot. This is equivalent to from 50 to 57.7 per cent of the tank oil originally in place. These are relatively high recoveries from Illinois reservoirs. Results of the analysis of these reservoirs and their performance determine the number of wells which should be drilled and the proper production practices.

Efficiency of Natural Water Drive—Ramsey Pool

M. B. PENN, Mid-Continent Petroleum Corp., Tulsa.

EFFICIENCY of natural water drive is calculated in a highly permeable sandstone reservoir, in which encroachment has taken place at rates causing a water table which is not level. This was done by determining the mean points of advancement and arriving at areas flooded and not flooded by plotted mean points on areal map.

The efficiency of this reservoir is high because of the rate of production, pressure maintenance by gas injection, uniform withdrawals from the various wells, and from producing the reservoir at the approximate solution pressure. Calculations show efficiency to be 66 to 82 per cent, depending upon the estimation of the portion of the section actually flooded.

Some Practical Considerations In Pressure Maintenance

LLOYD GRAY, Gulf Oil Corp., Tulsa.

DESPITE the many years pressure maintenance and unitization have been under consideration, there are still very few active projects. "Rugged individualism" alone does not adequately explain the dearth of projects, for there are a large number of community projects and partnerships where one or more parties lose some of their freedom of action.

Although engineers and scientists have made great strides in improving techniques

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of evaluating pressure maintenance, the engineers have done many things which tend to destroy confidence in their findings. If the situation is to be improved, the engineers must take steps to inspire confidence.

Conclusions drawn from discussions with various individuals favoring and opposing pressure maintenance are as follows:

1. Avoid, so far as possible, the cooperative project.
2. Require that all facilities, gas and gasoline plants, be owned by the unit.
3. Do not force a questionable project through.
4. The unitization contract terms on drilling and organization should be particularly generous to the operators.
5. The unit operator should have an adequate staff with the proper attitude to carry out the rather delicate control essential to obtain maximum benefit.
6. A lease stipulation should include a royalty pooling clause.

Unitization and Gas Injection In the South Burbank Pool

L. L. McWILLIAMS, Phillips Petroleum Co., Bartlesville, Okla.

THE South Burbank pool, located in Osage County, Oklahoma, is a Bartlesville sandstone lens similar in geological and reservoir character to many Bartlesville sandstone pools in northeastern Oklahoma and in eastern Kansas. First production was brought in in January 1934. Of the 4,160 productive acres in the pool, 2,760 acres were unitized in June 1935. Gas injection was started immediately. Originally, gas-cap injection was tried and in 1941 the operation was changed to injection over the entire unit. The results of pressure maintenance after 11 years of operation reveal great benefits of the unitization and gas injection over cooperative primary operations. Development costs were reduced 49 per cent; operating costs to recover the equivalent ultimate primary oil were reduced 81 per cent; ultimate increased oil recovery will be 87 per cent of the primary. A comparison with the nearby North Burbank pool, having similar geological and reservoir characteristics, where delayed cooperative gas repressuring was conducted, indicates the advantages of the early gas injection and unitization.

Improved Drilling Muds Containing Carboxymethylcellulose

H. H. KAVELER, Phillips Petroleum Co., Bartlesville, Okla.

AFTER giving an introduction to the development of drilling muds as a part of rotary drilling, the eventual features of colloidal chemistry as a function of mud technology were detailed. Twelve criteria of "good" muds were presented. The chemical and physical properties of water-dispersible cellulose were outlined preparatory to discussing the properties of muds containing carboxymethylcellulose on water loss, filtered cake thickness, viscosity, gell strength, and resistance to salt flocculation. Comparisons of the new cellulose mud mixture with starch and natural gums were made.

S. T. Raycraft, Shell Chemical Corp., has been advanced from chemist at the Martinez, Calif., refinery to technologist and transferred to the head office. **Clarence L. Dunn,** who has been chemist in physical chemistry at Shell Development's Emeryville, Calif., plant has been promoted to assistant department head of the same department.

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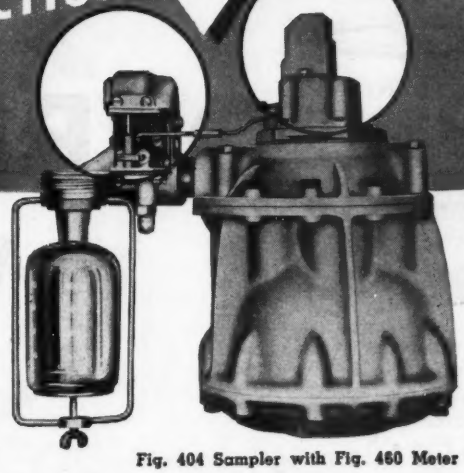

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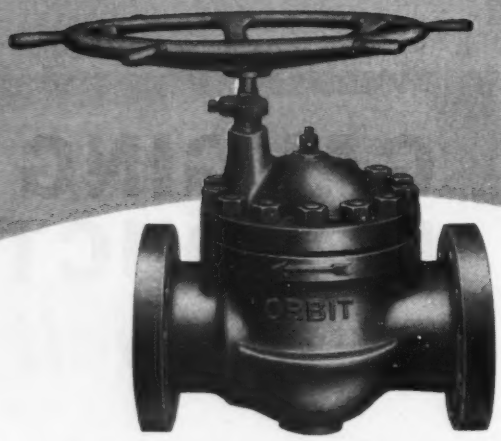

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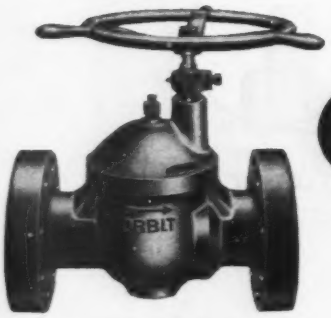

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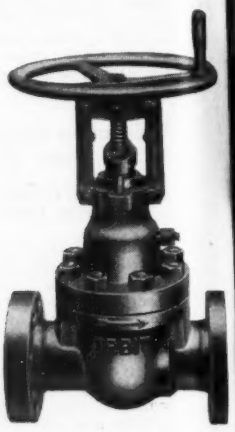

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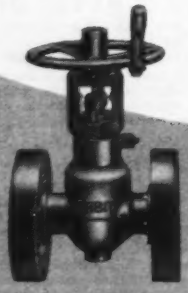

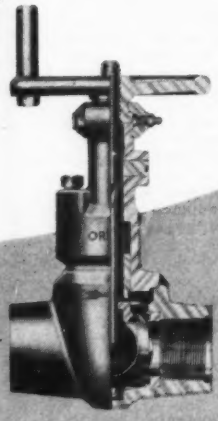

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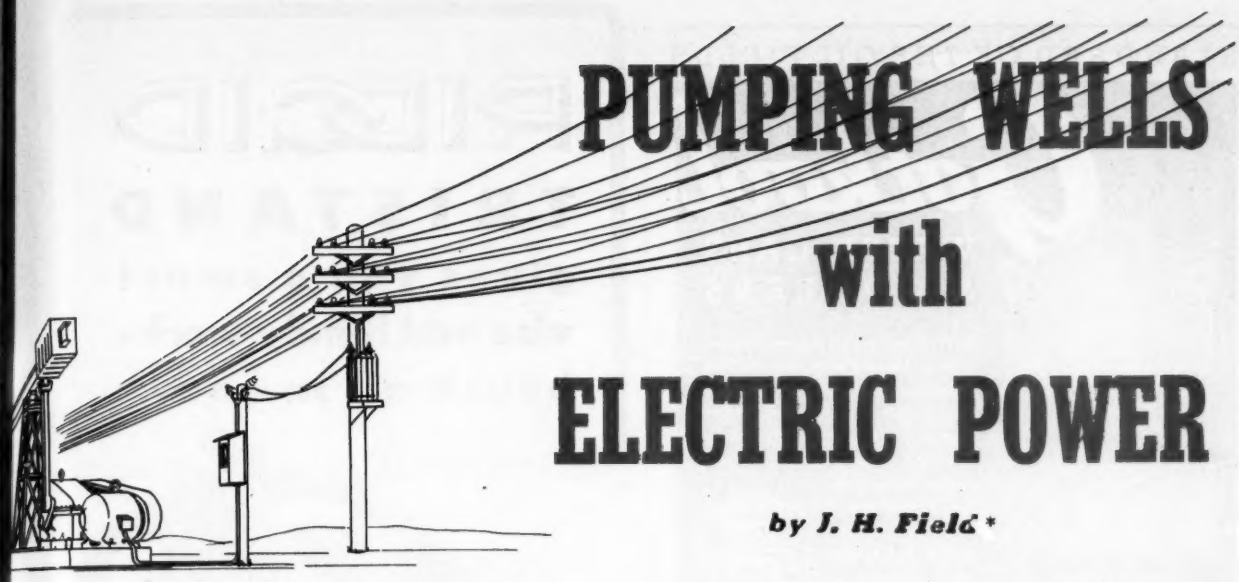

PUMPING WELLS with ELECTRIC POWER

*by J. H. Field**

This is the first of two parts of a paper which was delivered at the Mid-Continent district meeting, A.P.I. Division of Production, Oklahoma City, June 6. The various factors in pumping wells with electric power are here discussed, while in the second part of the paper, which will follow in a subsequent issue, the author takes up the cost of generating plants.

PUMPING oil wells with electric power dates as far back as 1892, when five wells on a lease in West Virginia were equipped with three-phase, 3-hp. motors.[1] In the early days of electrical pumping of oil wells, there were many wells operated with alternating current, and there were also a few installations designed for direct-current operation. Today, almost all electric motors used for pumping wells are operated by alternating current. The universal acceptance of a.c. power and the many advantages of alternating current over d.c. operation are well known by every student of electricity.

The petroleum industry has lagged behind all other major industries in the adoption of electrical power for the operation of principal equipment. This is especially true in production operations; there are many large companies that have fewer than 10 per cent of their total pumping wells operated by electric power.

There are several reasons why the oil industry has been so reluctant to use electrical power. In the first place, fuel has been available on a majority of leases in the form of natural gas, and without a market, the gas was vented to the atmosphere. Hence, it has been difficult to convince operators that electric motors should be installed for operation of pumping equipment, when the cost of electrical energy had to be compared with the cost of operation of gas engine for which there was no charge for fuel.

Another reason for the slow acceptance of electrical power for oil-field pumping was the use of inefficient pumping equipment. It was the customary practice to install rig fronts for individual well operation. The efficiency of the rig front was of minor importance as long as gas engines that operated on lease fuel were employed. The operators that installed electric motors on rig fronts soon realized that the inefficiency of this type of equipment was the primary cause of high charges for electrical energy. The early experience with electric motors was not soon forgotten, and even in recent years it has often been difficult to convince an operator that pumping wells with an electric motor could be economical.

The rig front had been used to service a well in addition to pumping it. With the introduction of the efficient and compact geared pumping unit in the late twenties, and the development of the portable well-servicing unit, there was no longer any need for installation of the rig fronts, although as late as 1939 new rig fronts were being installed.

Power Companies Hesitant

Power companies in the early days of electrical pumping were reluctant to extend their distribution lines to serve an oil lease. Knowing little of the loads that would be handled and the life of a group of wells, they were skeptical of a payout on the investment that they would be required to make, which consequently affected the number of electrical pumping installations. This skepticism in some degree exists today in certain localities.

Many oil fields have been isolated from any source of electric power, and if electric-motor operation was desired it was necessary to install a generating station. Operators hesitated to generate their own electricity, not being thoroughly familiar with all the factors involved.

As the number of engineers engaged in oil production operations increased, numerous tests were conducted in an attempt toward improving over-all pumping efficiency, leading to a reduction of electrical operating costs. Development of efficient, compact pumping units, improvement in electrical equipment, coupled with a decrease in cost, the extension of utility distribution systems, together with a reduction in the unit cost of purchased electrical energy, have aided in the increased activity in the use of electric power for pumping wells.

With increased use of electrical power, it became apparent that a considerable reduction in operating labor was possible through the use of electric motors rather than gas engines. With an increase in the complexity of problems on the labor front, operators became more inclined to consider electrical pumping. Even though natural gas was available on a lease, electrical operation appeared desirable. The rate of installation of electric motors, although somewhat retarded during World War 2 because of material shortages, is again on the upswing.

Electrical operation of pumping wells covers a wide field, including the use of electric motors for operation of central powers, the use of electric motors driving centrifugal pumps in the bottom of wells, and electric motors for individual pumping units. It therefore becomes necessary to

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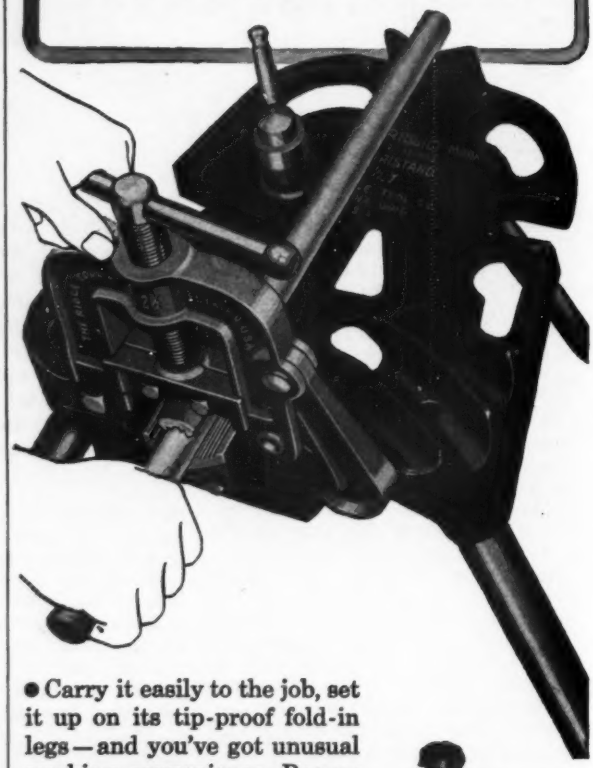

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limit this paper to one particular field, that being the electrical operation of wells equipped with individual pumping units.

Gas Engine Vs. Electric-Motor Operation

There are numerous advantages of a gas engine over an electric-motor drive, the most important being the flexibility of operation. In the production of oil, it is occasionally desirable to increase the speed of pumping temporarily for testing, etc., and to increase the speed of pumping with a gas engine, usually all that is necessary is a change in throttle adjustment. With an electric motor, which is normally a constant-speed machine, a change in pumping speed involves changing of the sheave size.

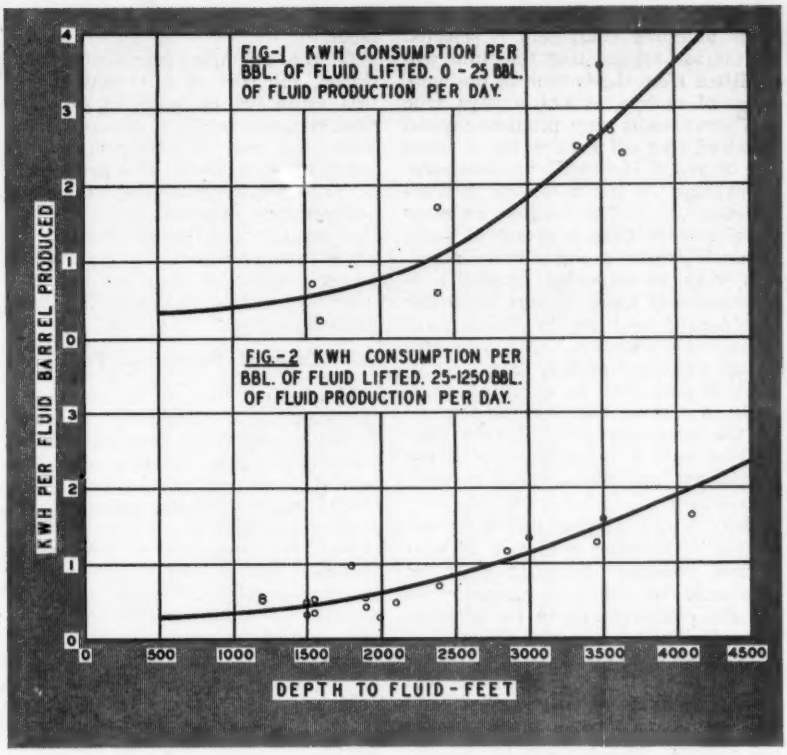
A motor is frequently installed to operate near its horsepower rating in order to obtain high efficiency, and any appreciable increase in load may necessitate replacement of the motor. A gas engine usually operates satisfactorily over a wide range of load conditions. Another advantage of a gas engine is that it can be installed in isolated regions and is independent of any central power system, and with electric-motor operation there must be a source of power reasonably close. A gas engine can often be operated on natural gas from the well it is pumping.

An electric motor has many advantages over a gas engine for pumping wells, the most important being less-frequent repairs and low maintenance expense. A motor may be operated for 15 or 20 years before rewinding becomes necessary. This is in contrast to a multicylinder gas engine, which usually requires a complete overhaul job every 2 to 4 years.

The load on a motor can be definitely determined by means of electrical instruments, which makes possible the investigation of wasted energy in the overpumping of wells. Also, the efficiency of pumping equipment such as well pumps, the relation of tubing size to load on a prime power may be investigated by means of electrical equipment. This is not possible with a gas-engine drive.

An electrical installation may be made with the assurance that the well will be operated at the proper strokes per minute as predetermined and not according to the whims of a pumper who sometimes may be inclined to pump a well at a higher rate than necessary, which may be injurious to the well.

The electric motor is a dependable prime mover and is simple to start in all-weather conditions. Pumpers have spent hours in trying to start gas engines, even with electric starters, this being especially true during cold weather. If natural gas is used for fuel, the gas lines frequently contain



water and freeze in cold weather. Water in the fuel also causes an unlimited amount of trouble in the engine itself.

Electric motors, whether large or small, are much easier to install than gas engines of the same horsepower rating. The compactness of the electric motor and its light weight per rated horsepower are desirable features whenever the prime mover is transferred.

Lower operating labor costs is another factor in favor of electric-motor operation. The amount of labor required to operate a group of wells with electric power may be half that required to operate the same wells with gas engines. The only attention required by the motors is lubrication about every 2 to 12 months. Gas engines require a daily checkup, frequent lubrication, and addition of water to the cooling system. Radiators for gas engines have to be drained in the winter when a part-time pumping schedule is employed, or else antifreeze must be added. In certain areas during cold winter nights, men are assigned to ride from well to well to check the operation of individual gas engines lest the fuel lines freeze and the engine stop, resulting in well downtime and lost production.

If a well be capable of making its daily production in part of a day, it is necessary for a pumper to visit the well to start the engine and then return later to shut the well down. Rather than pump a well part time, some pumpers often operate an engine the full 24 hours a day to avoid extra trips to the well or to avoid difficulties in starting.

Through the installation of a new device, gas engines may be stopped by time-clock control, but no satisfactory method has been developed for the starting of gas engines automatically. Electric motors with automatic starting and stopping eliminate the frequent trips to a well.

Electric motors are manufactured in accordance with N.E.M.A. standards and repair parts are usually available. There are times when gas-engine parts have to be ordered from a particular manufacturer, and if the engine be an obsolete model, repair parts may be hard to obtain, which may result in excessive downtime on the well.

Other Advantages

Among the less-important advantages in using electrical equipment are the high salvage value, and the fact that when electrical energy is used for pumping, it is also available for other purposes on the lease.

Procedure in determining the feasibility of operation with electrical power is first to determine the loads that may be imposed on the electrical system. To do this requires a study of the drilling program if the pool is under development. Not only is it necessary to know the approximate number of wells that may be operated electrically, but it is just as important to have some idea of the amount of fluid that will be pumped and the

pumping depth. In the majority of cases pumping equipment is selected on the assumption that the fluid will be lifted from the bottom of the well. This, of course, is not always true and some wells may produce several hundred feet off bottom for a number of years. It is well to have some knowledge of the reservoir characteristics. . . . . The load on an electrical system from a group of wells producing from a water-drive reservoir may be expected gradually to increase with time, as more and more water must be lifted to obtain maximum oil production. . . . . The load on an electrical system in a gas-expansion pool may be expected gradually to decline, and towards the end of the economic pool life the load will be only a small fraction of the maximum load during peak production. . . . .

Once a gas engine has been installed, it becomes a matter of economics whether it would be more profitable to continue operation of the gas engine or go to the expense of replacing the engine with an electric motor.

Anyone not familiar with oil-field operations may wonder why the oil industry should not replace all the gas engines with electric motors for pumping wells, since electric motors may be operated by automatic control, have less maintenance expense, and require less attention by the pumper.

Maintenance Expense

Where free fuel is available on the lease in the form of natural gas the expense of operating a gas engine may not be nearly as great as the cost of electrical energy to produce the same well. For instance, engine-maintenance expense including overhaul jobs for a 10-hp. load will average approximately $0.50 a day for a particular type of engine. The cost of electrical energy to operate the same pumping unit 24 hours continuously would be in the neighborhood of $1.79 per day at an electrical energy rate of 1 cent per kw. hour. The daily charge for electricity would be more than three times the gas-engine maintenance expense.

The only argument for electrical power in this case would be the reduction of pumper labor to operate the unit. But unless it is possible actually to reduce the number of men operating a property, the saving in labor would not be so important. Reference is made to a group of wells that would be operated by one man. Regardless of whether the wells be operated with electric motors or gas engines, it still might be necessary to have a pumper full time to operate the property. Should it be possible to reduce operating labor through electrification, it remains to be determined if the cost of electrical energy would be greater than saving in labor.

In the example previously mentioned, the cost of electrical energy was estimated to be $1.79 per day. Should there be 10 such wells on a lease, the cost of electrical energy would amount to over $537 per month, or $387 greater than the gas-engine maintenance expense. Operating labor would have to be reduced by more than one man for the 10-well group in order for electrical operation to be more economical than that with gas engines.

Case of Purchased Fuel

Should fuel have to be purchased, the picture is completely changed. Depending upon the type of fuel and prevailing prices, the cost of operation of a gas engine may be considerably more than the electrical operating charges. If gasoline be purchased for operation of an engine having a load of 10-hp., it would not be unreasonable to expect a charge for fuel of $3.00 per day. Added to this would be the engine-maintenance expense, and the total cost of operating the internal-combustion engine would amount to approximately twice that for an electric motor.

The charge per kilowatt hour for purchased electrical energy will depend on the rate schedule of the utility serving that particular area. The electrical power charge will vary with the kilowatt hour consumption. It is conceivable that the cost of electricity to produce a barrel of fluid from a well which is one of a large group may be half that for an offset well operated by another company having only a few wells connected to the electrical system.

Engineers are daily investigating ways and means of reducing oil-well lifting costs, and analyses are continually being made to determine if it be more profitable to install electric motors rather than gas engines. And, frankly, there are many instances in which electrical operation is not justified.

There are particular areas in which electric-motor operation of pumping wells is more desirable than gas engines, even though natural gas be produced on the lease. This applies to wells located in cold climates, such as Wyoming and possibly Michigan, where gas engines are often hard to start in cold weather. In sour gas areas considerable trouble is experienced by the action of the gas on the parts of an engine.

The lack of sufficient natural gas for fuel in Illinois and the concentration of small producers, many of which pump off, and with many producing horizons less than 3,000 ft. deep, make certain pools in Illinois particularly suitable for electrical operation.

One important factor in the decision of whether to equip wells for electrical operation is the distance between wells. The possible savings with electric-motor over gas-engine operation may not be sufficient to justify the investment to install a distribution system to connect wells that are a considerable distance apart. . . .

In any consideration of electrical operation, the number of hours that each well pumps daily will have a decided effect on the capacity of the electrical equipment to be installed. Obviously, the electrical load for a group of wells pumping 24 hours a day will be approximately twice that for the same group of wells operating 12 hours a day, each on a staggered pumping schedule. The capacity of transformer banks and the distribution systems will depend on the number of hours each well is operated daily.

In flooded areas, where roads become impassable, electric motors are desirable, as it is not essential that a pumper visit the well each day as with gas engines.

Perhaps one of the most important factors to be considered when considering the type of equipment to be installed is the economic life of the well in question. Small producers having an economic life of less than 5 years are not uncommon. Certainly the cost of installation of the electrical equipment, including the distribution system, must be weighed against the payout of the system over the life of the wells. . . .

Selection of Electric Motors

The selection of motors for oil-field pumping is often difficult due to the fact that there is no way of accurately determining the magnitude of the loads that must be handled by the motor. Frequently, the motor has to be selected before pumping conditions are definitely known. Also, the motor is expected not only to be able to handle the present well loads, but also the loads that may be imposed in the future. With such variables as the rate of production, the percentage of water in the fluid, the amount of gas in solution, the bore of the pump, the length of stroke, the number of pumping strokes per minute, the amount of lift, etc., the selection of the proper size motor is based to some degree on experience.

If the motor load is expected to change rapidly over a period of a few years, then a double or triple-rated motor is often desirable. When the load on the motor exceeds the first rating, the higher side of the motor may be used without effecting any change in physical equipment.

There are several methods used for the selection of the size of motor to pump a well, which include: (a) hydraulic horsepower, and (b) assumed

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electrical energy consumption per barrel of fluid.

The approximate size of motor required to pump a given well may be determined by multiplying the calculated hydraulic horsepower by a factor of 2.9 for normal-slip motors and 2.5 for high-slip motors.

The second method of determining required motor size is by use of data obtained from other wells as to the electrical energy consumption per barrel of fluid lifted. The kilowatt-hour consumption for over 1,500 pumping wells is summarized in Table 1. The wells range in depth from 1,200 to 4,500 ft., with maximum fluid production of any one well being 1,250 bbl. a day. It will be noted that the electrical energy consumption was reduced to kilowatt hours consumed per barrel of fluid lifted per 1,000 ft.

The kilowatt-hour consumption to pump a barrel of fluid from a given depth is by no means constant over the life of a pool. During the period of flush production when gas has a tendency to break out of solution and assist the upward movement of oil, very little outside energy is required to produce the well. Later, as bottom-hole pressure decreases and the percentage of water in total fluid increases, the kilowatt hours required to produce a barrel of fluid will continually increase to the end of the life of the pool.

A certain amount of power is required to overcome frictional losses in pumping equipment. The frictional losses are small compared to the total power transmitted during periods of maximum production. However, the frictional losses for the same wells after production has declined often accounts for a large portion of the total power required to pump the well. It is not infrequent that a motor is permitted to operate after the well has pumped off. These facts, together with the fact that electric-motor efficiency decreases with diminished load, partially account for the variation in kilowatt hours consumed per barrel of fluid lifted.

TABLE 1—KW.HR. CONSUMPTION PER BBL. FLUID LIFTED

Bbl. fluid per day	Per cent oil in total fluid	Kw.hr. per bbl. fluid lifted	Depth to fluid feet	Kw.hr. per bbl. fluid lifted per 1,000 ft.	No. wells
0-25 Bbl. Fluid per Day					
6	40	2.10	1,600	1.30	3
6	80	2.40	3,650	.66	10
7	65	2.50	3,350	.75	23
8	62	2.70	3,570	.76	6
11	88	3.55	3,500	1.00	6
15	50	1.70	2,400	.70	4
16	70	2.60	3,440	.76	11
18	80	0.70	1,550	.45	1,022
21	93	0.57	2,400	.32	9
25	100	0.87	4,300	.22	18
Total No. wells					1,112
Weighted average electrical energy consumption per barrel fluid per 1,000 ft.				0.46 kw.hr.	
25-50 Bbl. Fluid per day					
26	78	0.57	1,900	.30	65
31	69	0.99	1,800	.55	31
34	..	0.53	1,200	.44	8
38	40	1.57	3,500	.45	11
40	99	0.72	2,400	.30	40
46	59	1.32	3,300	.40	11
Total No. wells					166
Weighted average electrical energy consumption per barrel fluid per 1,000 ft.				0.37 kw.hr.	
50-100 Bbl. Fluid per Day					
50	100	1.15	2,850	.40	84
52	21	.32	1,500	.32	4
56	45	2.50	4,500	.56	20
60	28	.54	1,550	.35	25
61	6	1.27	3,460	.37	8
63	91	.43	1,800	.24	8
67	20	.50	1,500	.34	5
68	63	.50	2,100	.24	22
Total No. wells					176
Weighted average electrical energy consumption per barrel fluid per 1,000 ft.				0.28 kw.hr.	
Above 100 Bbl. Fluid per Day					
96	62	.20	2,000	.15	14
102	35	.57	1,200	.48	31
129	16	1.63	4,100	.41	83
1,250	14	.34	1,550	.23	4
Total No. wells					122
Weighted average electrical energy consumption per barrel fluid per 1,000 ft.				0.39 kw.hr.	

Energy Consumption

In a water-drive field the kilowatt-hour consumption per barrel of fluid lifted would be expected to increase as the percentage of water in total fluid increases.

In the tables shown it will be noted that the energy consumption ranged from 0.22 kw. hr. to a maximum of 1.30 kw. hr. per barrel of fluid lifted per 1,000 ft.

The average electrical energy consumption to produce the wells included in this discussion is shown graphically in Figs. 1 and 2. A separate curve has been drawn for wells producing less than 25 bbl. of total fluid per day.

To select the size of motor for any given set of conditions, first determine the kilowatt-hour consumption per hour based on the curves shown. Multiply this figure by 1.34, which will equal the approximate horsepower input load on the prime mover. This multiplied by a factor K as explained below will equal the horsepower rating of the motor to be used.

Rating of motor = Fluid produced per hour × kw. hr. consumption per bbl. fluid × 1.34 × K.

Allowances must be made for a possible increase in fluid to be handled, or the possibility of paraffin being deposited in the lead line and tubing, causing an increase in load.

Also, it must be clearly understood that an electric motor with a rating of 5 hp. will be considerably overloaded electrically if the average load output imposed on the motor equals 5 hp. This is illustrated in the following example from recent tests taken on a well in Illinois.

It will be noted in Table 2 that the average load on the 7½ hp. motor as shown by the wattmeter was 5 hp., and that the average thermal demand was 28.2 amp. as compared to the motor rating of 21 amp.

This indicates that the electric motor was only 66.7 per cent mechanically loaded and 134 per cent electrically loaded. Since the load on a motor is determined by the electrical loading, a motor will not handle its rated horsepower output under pumping well loads. The reason for this is readily understood when the current fluctuation in a motor is studied. The current peaks may be twice the rated current of the motor and still the average load be within the horsepower rating of the motor.

It becomes necessary then to use an application factor K for motor selection. An application factor of .70 is common for motors having a normal or medium-slip rating, and a factor of .80 for high-slip motors. The above factors take into consideration the efficiency of the motor.

TABLE 2—TESTS ON ELECTRIC MOTOR

(Showing relation of mechanical load to electrical load).

Production, bbl. per day fluid	230
Motor rating, 220-volts	7½ hp.
Motor efficiency, approximately	86%
Length stroke, in.	44
Strokes per minute	20½
Depth well, ft.	1,600
Motor r.p.m. (synchronous speed)	1,200
Motor r.p.m. (full load speed)	1,160
Hydraulic horsepower required	2.7
Actual horsepower output motor	5.0
Ratio of actual horsepower to hydraulic horsepower	1.85
Rated motor amperes	21
Maximum amperes actual:	
Well load	62
Counterbalance	53
Average thermal demand, amperes	28.2
Per cent electrically loaded	134
Per cent mechanically loaded	66.6
Power factor, per cent	62

Type of Motor

Most motors that are used for oil-field pumping are usually high-torque, low-starting-current motors.

TABLE 3—TESTS WITH NORMAL SLIP AND HIGH SLIP MOTOR (SAME WELL)

Well Data	
Depth to fluid, ft.	1,000
Length of stroke, in.	34
Bore of pump, in.	2¾
Production, oil, bbl. per day	240
Production, water, bbl. per day	600
Production, total fluid, bbl. per day	840
Electric power, 3-phase, 480 volts.	

	Test 1 normal slip motor	Test 2 high slip motor
Motor rating, horsepower	25	30
Synchronous speed	1,200	1,200
Full load speed	1,175	1,080
Per cent slip of motor	2.1	10.0
Rated amperes, full load	35	39
Actual peak amperes:		
Polish-rod	90	52
Counterweights	68	53
Average amperes (r.m.s.)	40.0	28.4
Per cent of rated amperes	114.0	72.8
Actual horsepower output	20.8	18.1
Per cent horsepower output to rated horsepower motor	83	60
Strokes per minute	36	35
Power factor	68	65

One of the most important characteristics of an oil-field motor is the amount of "slip."

"Slip" of a motor is the speed variation between full-load and synchronous speed. For all practical purposes, synchronous speed may be considered as no-load speed.

Slip is important from the standpoint of the magnitude of the peak currents developed in a motor, and the peak current drawn from the distribution system. This applies mostly to motors with a rating of over 10 hp., and is especially applicable to wells operating at over 20 s.p.m.

A normal-slip motor will tend to maintain a constant speed when a heavy load is applied. Consequently, considerable current is drawn in an effort to meet the peak instantaneous horsepower requirements.

A high-slip motor has a greater tendency to slow down as load is increased and, hence, the maximum current demand is not as great with a high-slip motor as with a normal-slip motor for the same loading conditions. This is illustrated in Table 3. A pumping load applied to a 25-hp. normal-slip motor was approximately 20.8 hp. The peak current on the well upstroke was 90 amp., or nearly three times the current rating of the motor. The average motor current was 40 amp. as compared to the full-load motor rating of 35 amp. The motor was therefore changed to a 30-hp. high-slip motor.

Following the change, the peak current on the well due to the well load upstroke was only 52 amp., indicating a 42 per cent reduction in the ampere demand. The most important fact established by these tests was the reduction in thermal demand amperes from 40 when using a 1,175-r.p.m. motor, to 28.4 when using a high-slip or 1,080 r.p.m. motor. In this case, the well was operating at 36 s.p.m. The test demonstrates that high-slip motors have a definite application in oil field pumping operations.

One disadvantage of a high-slip motor is the fact that the thermal overload relays will not always protect the motor against stalled single-phase, or stalled three-phase, which leads to burning out of the motor.

The high-slip motors are especially desirable to operate wells that become under or overcounterbalanced due to changing well conditions as a result of accumulation of paraffin in flow lines and tubing, which increases the load on the pump upstroke or by wells pumping off or flowing heads, etc.

All of these factors must be considered in the selection of electric motors.

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Welding Hazards and Safeguards

*by Henry W. Boggess**

WELDING is an ordinary routine in oil-field work. Despite common usage, a surprisingly large proportion of oil-field workers are unfamiliar with welding techniques and particularly are they insufficiently advised of welding hazards.

Health Hazards

Ultraviolet and infrared rays are forms of radiant energy just the same as radio, X-ray, and wireless rays. Even though invisible, ultraviolet and infrared rays are powerful and are usually present with harmful radiance. The welding flame and the welding arc are rich in these harmful rays and it is therefore incumbent that ample protection be provided onlookers, passersby, and helpers, as well as welders.

Ultraviolet rays are chemical in action and cause eye irritations and burns to the skin. Snow blindness, desert blindness, and "eye flashes" of welders are very similar and are due to ultraviolet rays. Effects are often very painful and may cause prolonged but temporary disability.

Infrared rays act upon the eyes simply as heat. It is possible that continued exposure of eyes to infrared radiance may cause permanent damage. Many welders have suffered near blindness because of a "haziness" forming on eyeballs.

*Superintendent of personnel department, Sinclair Prairie Oil Co.

SAFE field PRACTICES

Protective Measures

So far as the effects of radiant energy are concerned, welding processes may be placed in two groups:

1. Welding processes requiring only a slight reduction (by means of eye protection) of visible radiant energy, including oxyacetylene and oxyhydrogen welding and cutting; also electric resistance welding.

2. Welding processes requiring a larger reduction (by mean of eye protection) of visible radiant energy, such as electric arc welding and cutting.

For the first group above given, goggles, face masks, helmets, and shields may be used. Goggles may be with or without side shields or with flexibly connected lens containers shaped to conform to the face. Lenses should be either black, amber, green, or greenish yellow. Greenish yellow is considered the best for protection from ultraviolet rays.

For the second group, only the helmet or hand shield should be used as goggles do not give sufficient protection. The darker shades of glass only should be used to guard against intense infrared radiance. Dark shades such as black, green, and yellowish green not only cut down light but guard against both ultraviolet and infrared rays.

A chart of lens densities for welding operations as issued by Bureau of Standards is as follows:

Type of job—	Glass shade	Per cent: Visible light transmission	Per cent: Dangerous ray absorption: Ultraviolet	Per cent: Dangerous ray absorption: Infrared
Heavy acetylene cutting and welding	#8	0.10	100	99.9
Acetylene welding and setup on electric welding	6	0.72	100	99.9
	5	1.90	100	99.8
Acetylene cutting, burning and brazing	5-4	5.2	100	99 5
Light brazing	3	14.0	99	98.0

In using unnumbered colored safety glasses referred to by shades such as "extra dark," "medium dark" and "light," use the following chart:

Type of job—	Glass shade	Per cent: Visible light transmission	Per cent: Dangerous ray absorption: Ultraviolet	Per cent: Dangerous ray absorption: Infrared
Ladlemen, spot flash, and seam welding	Extra dark	20	100	95
	Medium dark	35	100	92
Persons in areas of electric welding, stray or reflected light, low temperature fire box observation, rivet heaters, ladlemen and hand pourers	Light	53	100	80

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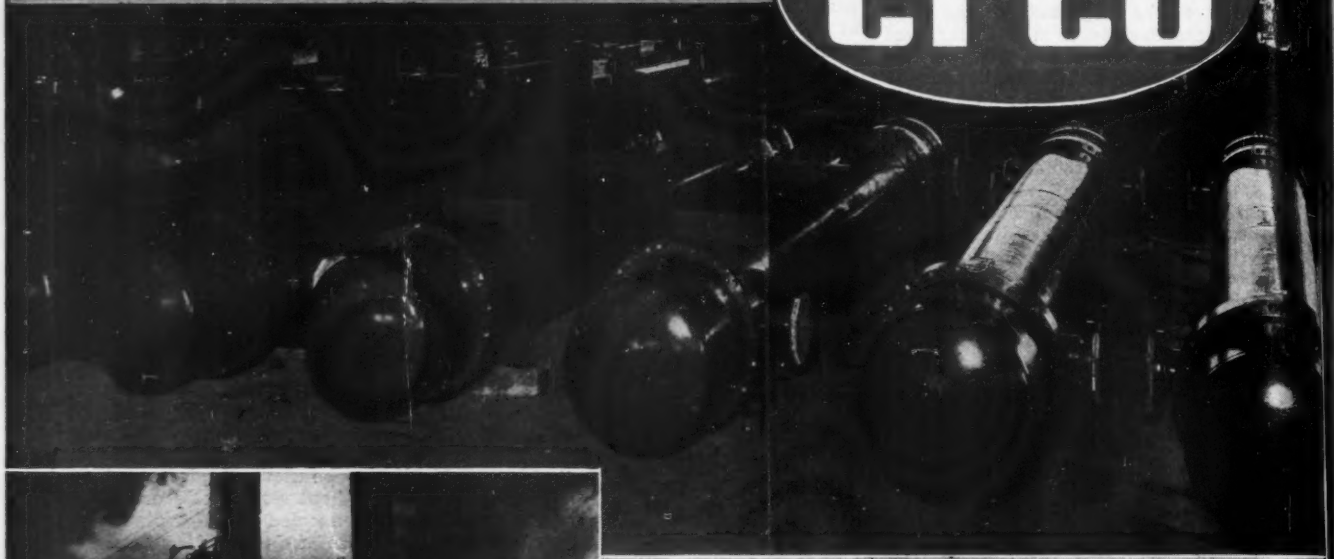

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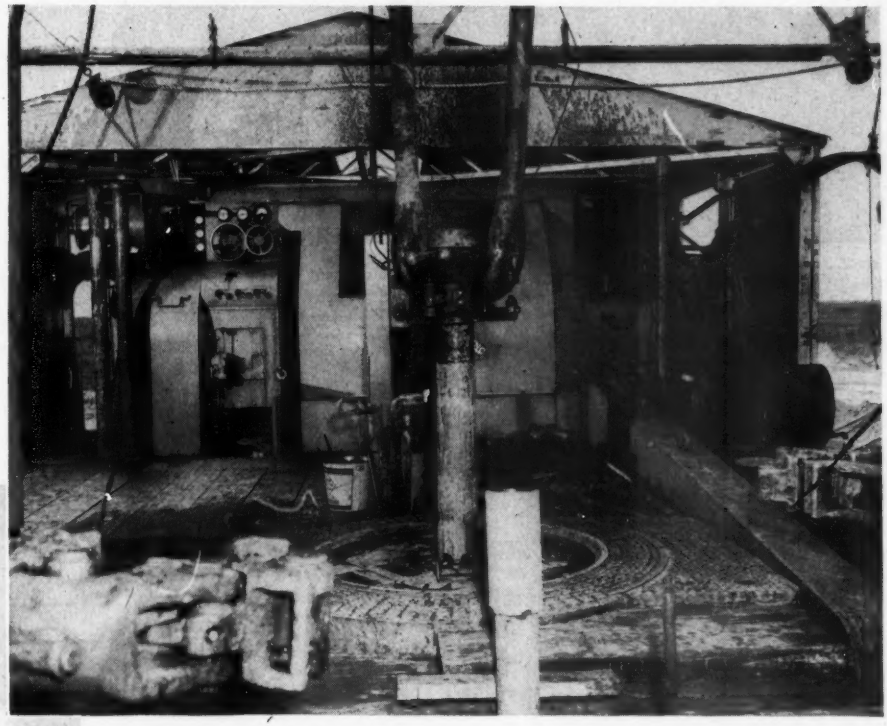
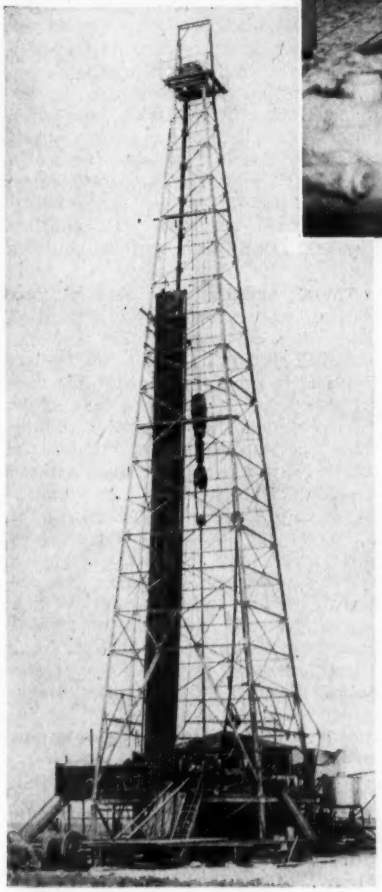
Multispeed Rig Gives High Flexibility Between Rotary Table and Pumps

by Kenneth B. Barnes

Right—Floor view of the draw works of the new rig. At the driller's panel are centralized the air-actuated speed controls (nine on hoisting, nine on rotary, nine on sand reel)



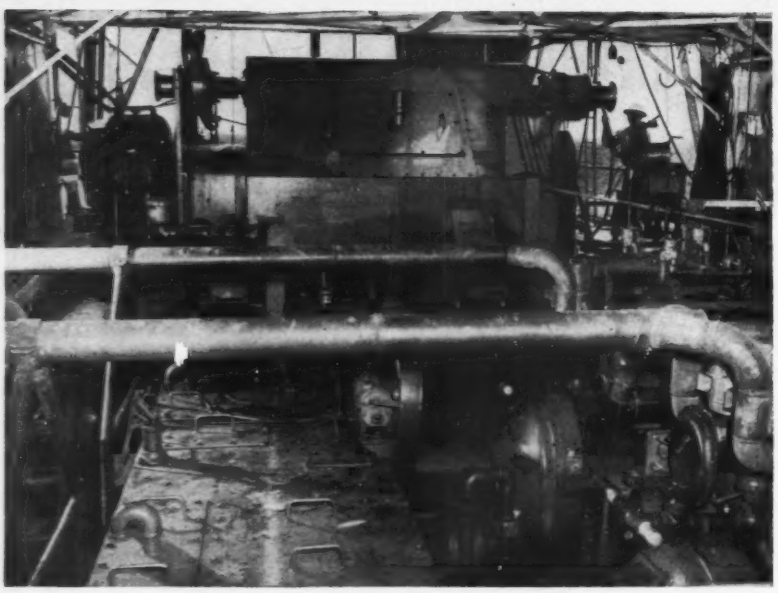
Below—Drilling job for the new multispeed power rig on Atlantic Refining Co.'s 1-D University Lands, Martin pool, Andrews County, West Texas. This location is in Section 2 of Block 11. The 13⅜-in. surface string was cemented at 296 ft., the 5½-in. at 9,010 ft.



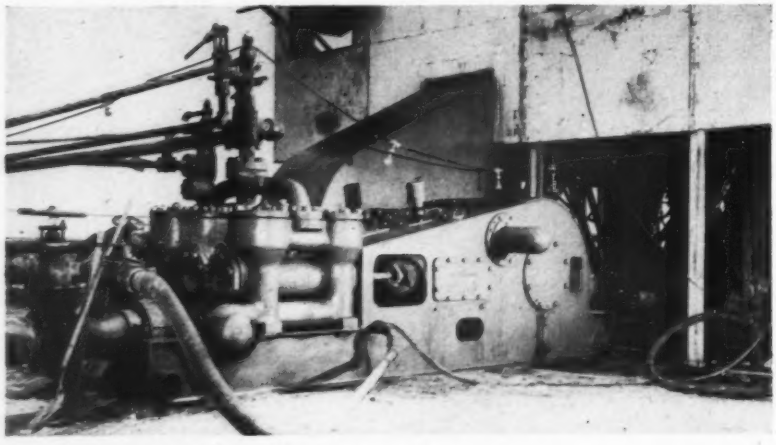
INCESSANT demands to hold down drilling costs in the many active, deep, hard-digging areas now under development are being answered by the appearance and use of a number of new, heavy-duty-type rotary rigs. The Clark Ideco PR-1000 power rig described here introduces a number of interesting and valuable additions in rig design, and notably in flexible performance, as shown up in the unit operated by Thompson-Carr, Inc., of Houston, in a current 9,000-ft. operation in the Martin pool of West Texas.

The new rig has nine hoisting speeds, nine rotary speeds, nine sand-reel speeds, and nine reverse speeds. The multispeed control is handled by the driller through a single handwheel which permits him to select, either forward or backward, any of these nine speeds. This makes a very flexible over-all mechanical operation as whatever rotary table speed is desired can be selected and changed at will, even though all of the engines are tied together to permit maximum horsepower to be applied to either one or two slush pumps. Through the rig compounding system, the possibility is afforded to operate two pumps through separate prime movers and compound the pumps, and the power also may be distributed so as to operate the pumps in parallel or separately.

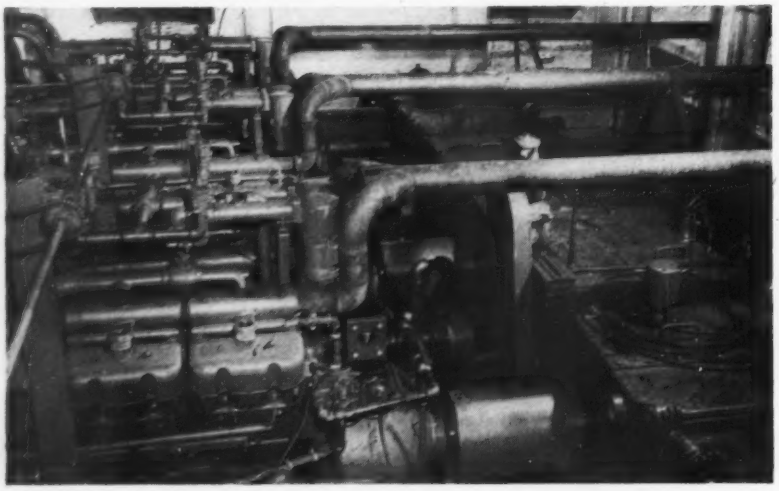
Taking a look at the principal design features of the major components of the rig, the braking system has a large net or effective brake-band area, yet is quite simple in that only one adjustment is required. The brake rims are water cooled and a double hydromatic brake is connected to the drum shaft with a disconnecting coupling. The drum is long and of large diameter (30 by 46½ in.), and requires only two cutbacks to handle 90-ft. stands with eight lines strung. Rotary countershaft on this rig is mounted in front of the draw works and is extended for use as a rathole drive. When a sand reel is used, it is mounted in a position provided on top of the draw works.



Looking at back side of draw works, over compounding unit and transmission. Spinning cathead is on driller's side, an automatic cathead on the opposite



Triplex-type slush pump on this installation is set on ground, driven via 12 V-belts. Various rotary speeds, through the mechanical system employed, can be used even with all engines compounded to give maximum horsepower to the pump or pumps



Normal power input to the rig is designated as 1,000 hp. On the Thompson-Carr, Inc., new unit in West Texas, which is operated as its rig No. 10, three 350-hp. V-type 12-cylinder LeRoi engines are used. The compounding unit is enclosed in a welded-plate box-type housing which has separate oil-tight compartments for the Clark-air friction clutches to seal against oil spray. The shafts are mounted in self-aligning roller bearings and may be connected to the engine-power take-off shafts by either flexible couplings or Fawick airflex clutches. All the compounding drives are quadruple chain.

The transmission is of welded construction and the box-type housing which is formed is oil tight. All the friction clutches here also are enclosed within separate compartments to provide a seal against oil spray. The transmission is equipped with Clark-air disk clutches, these being directly actuated by air pressure on the pressure plate. The air compressors and tanks which form a part of the pneumatic system are so mounted as to be readily accessible. The clutches are of single and double-plate type, and the design of the single-plate ones is such that they are interchangeable with those used in the compounding transmission. A counting up of the items shows that there is somewhat over 90 per cent interchangeability of parts in all clutches in the rig, except the master clutch located on the drilling shaft of the draw works.

Lubrication of the chains in the draw works, transmission, and compounding units is by pressure spray, the roller bearings by oil pressure or Alemite fittings. The Alemite connections to the brake and other points are grouped together to facilitate greasing at any time without shutting down.

The air-actuated controls which are centralized at the driller's position have been designed in the new mechanical system to give, either selectively or in progressive order, the nine different speeds to the rotary table. This provides a good range of revolutions per minute through which the rotary table may be operated without throttling the engines. Such flexibility, of course, permits operation of the pump at the most favorable speed when both pump and rotary are being driven by the same engines. The engines may be split up as to their power delivery by operating No. 1 engine on the rotary table, Nos. 2 and 3 engines on the pump, or any combination desired. The engines themselves can be synchronized at all speeds with the Westinghouse engine air-controlled system.

Left—Showing welded, oil-tight construction of transmission and compounding unit, with compartment clutch sections. Three 350-hp. V-type 12-cylinder engines are connected

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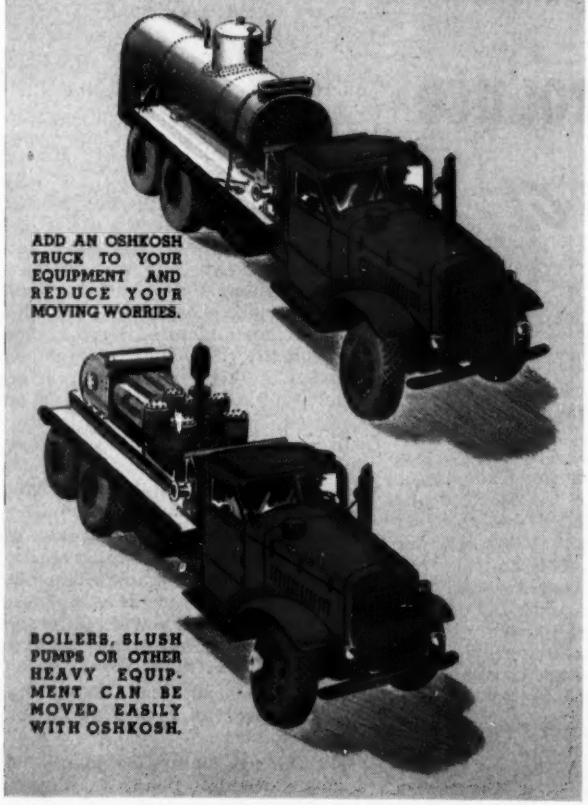

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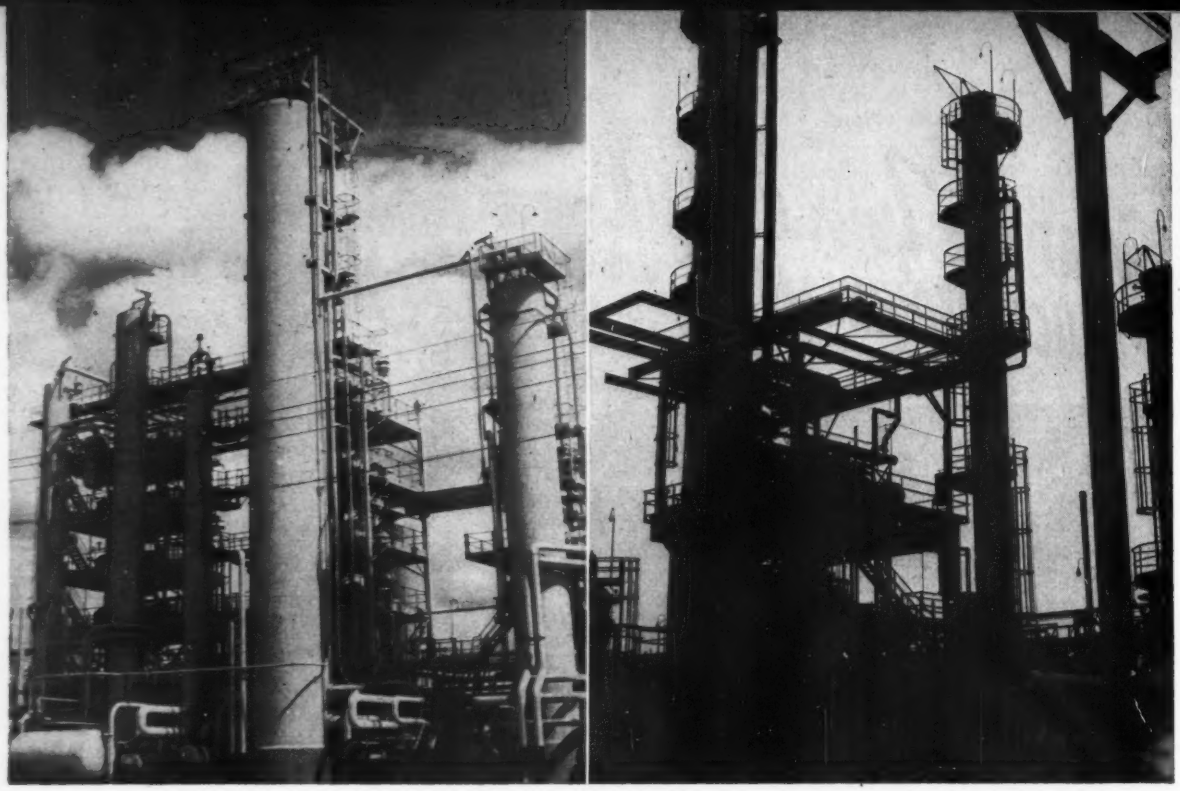

Left: Sulfuric acid alkylation plant at the Beaumont, Tex., refinery of Magnolia Petroleum Co. Right: Hydrofluoric acid alkylation plant at the Paulsboro, N. J., refinery of Socony-Vacuum

Refiners Ready to Produce *Aviation Safety Fuel*

by Fabian R. Staley

THE petroleum industry is ready to go ahead with the manufacture of aviation safety fuel. Recently some manufacturers of airplane engines have developed injection systems by means of which an exact quantity of fuel is metered into each cylinder. Engines so equipped may soon be available, and some prominent engineers predict a sudden demand from airlines.

Safety fuel has a much higher flash point and a higher initial boiling point than conventional gasoline, and therefore presents no fire hazard. Although it might catch fire, the tendency to spread and get out of control does not exist since it contains no highly volatile hydrocarbons. Safety fuel should be about as safe as kerosene, having about the same flash point, but it must also have a high octane number.

A comparison of the properties of a conventional aviation gasoline and of a safety fuel is shown in Table 1.

Safety fuel can be manufactured by alkylation or by polymerization plus hydrogenation. In the alkylation process, two light gases are used: naturally occurring isobutane, plus refinery gases of the olefinic type. Molecules of these gases combine in the presence of certain catalysts to form larger liquid molecules of the isoparaffinic type. A portion of the total product can be selected that is suitable for use in safety fuel. This material has a good tetraethyl lead susceptibility. When leaded, it has an octane number about 100 under lean-mixture conditions. Its rich-mixture performance may require some improvement. This can be accomplished by the addition of an aromatic blending stock produced from catalytic cracking.

TABLE 1

	Safety fuel	Aviation gasoline
Gravity, °A.P.I.	56.7	63.1
Specific gravity	0.752	0.727
Distillation, °F.:		
I.b.p.	300	100
50 per cent	345	220
90 per cent	380	275
F.b.p.	400	320
Flash (closed cup), °F.	100	—50
R.v.p., psi.	Less than 0.5	7.0

Octane rating, stability, etc., the same for both types.

Polymerization plus hydrogenation starts with olefinic gases, and hydrogen gas is made to combine with the liquid molecules formed by polymerizing the gases. By this method, it is possible to produce a nonvolatile fuel having better all around antiknock properties than that produced by alkylation. However, at present only a small volume of safety fuel could be manufactured by this process, and the cost would be high. Because of the high rich-mixture octane number of aromatic stock, it is anticipated that some aromatic stock will be blended with safety fuel produced by the alkylation process. The alkylation process is much more widely used than is polymerization.

Any suggested specifications for safety fuel are only tentative, and are subject to considerable change before refinery practice is established. At present there is a wide difference of opinion as to how high the flash point should be.

In airline operation, safety fuel might reduce fire hazard at the following points:

(1) During fueling of planes, (2) during storage of planes in hangars, and (3) at the time of accidental, or crash landings. It is reasonable to assume that an ample supply of safety fuel will be available to meet aviation needs whenever engines are equipped to use such fuel providing specifications are not too exacting and an interval of time is allowed for adjustment in existing refineries.

The Refiner's Notebook

A WEEKLY FEATURE OF THE OIL AND GAS JOURNAL

Pressure Drop Through Tube Side

ACCOMPANYING Fig. 1 is the pressure drop of petroleum oils through exchanger tubes. The effect of diameter is almost linear between ⅝ in. and 1¼ in. and hence the friction loss through other sizes can be estimated by interpolating between the values shown.

Specific gravity is extremely important in the use of the figure because it was used to introduce viscosity. There is a consistent relationship between viscosity and gravity (at the same temperature) for all types of oils, be they light or heavy. The specific gravity of the oil at its average temperature in the exchanger (or better yet at its film temperature) can be obtained by the use of The Refiner's Notebook No. 88, page 121, April 13, 1946.

Pressure drop is shown for a length of tubing of 10 ft. The total length of travel should be used, i.e., the number of passes should be multiplied by the tube length.

Inlet and outlet. — Enlargements and contractions at the inlet and outlet of the exchanger and for each pass can be computed from:

$$\Delta P = 0.01(p + 1)\ Su^2$$

in which p is the number of passes, S is the specific gravity at the average temperature and u is the velocity in the tubes. Table 1 shows in-and-out pressure drops for typical conditions. Note that the values of Table 1 should be multiplied by the number of passes plus one (p + 1).

TABLE 1—PRESSURE DROP PER PASS (AND IN-AND-OUT) OF EXCHANGERS—PSI.

Spec. grav.	Velocity of 1	2	4	3
0.6	.006	.024	.096	.384
0.65	.006	.026	.104	.416
0.7	.007	.028	.112	.448
0.75	.007	.030	.120	.480
0.8	.008	.032	.128	.512
0.85	.008	.034	.136	.544
0.9	.009	.036	.144	.576
0.95	.009	.038	.152	.608
1.0	0.10	.040	.160	.640

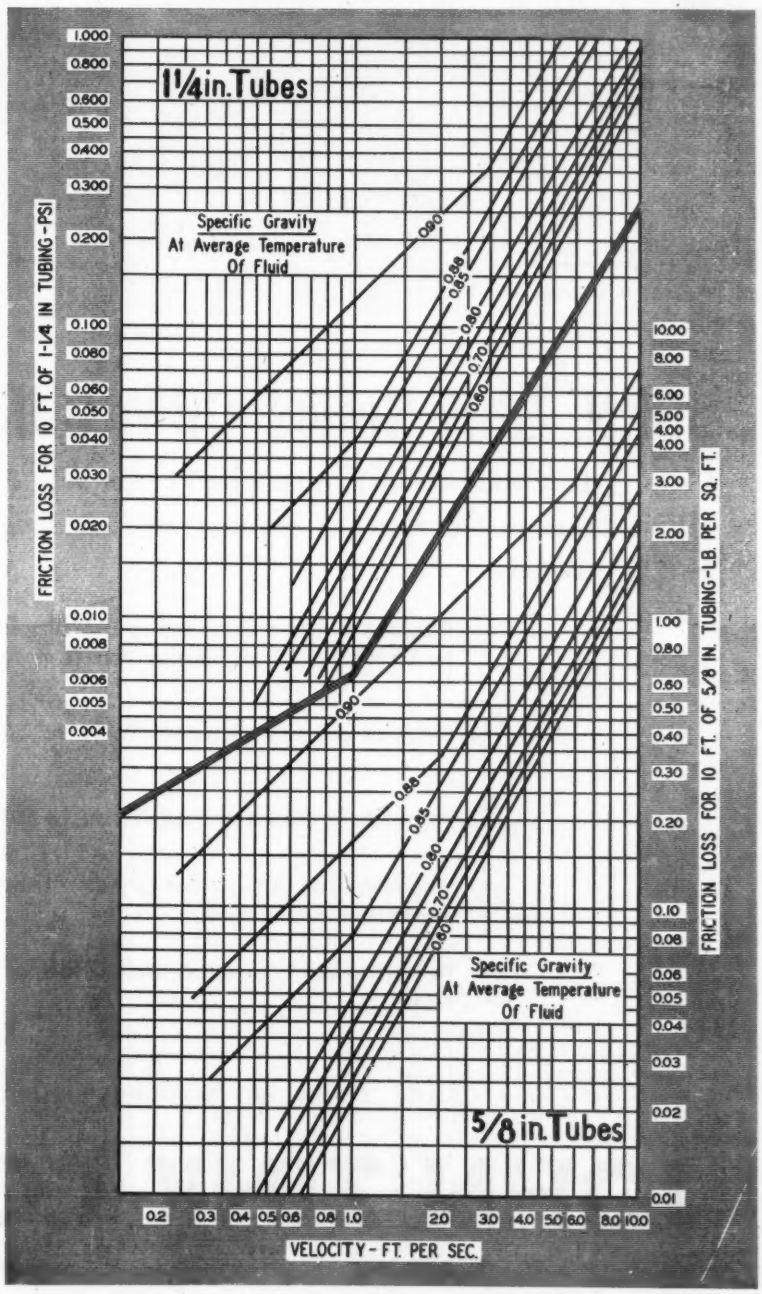

Fig. 1—Equivalent fin-side area per square foot of inside area

No. 97 in a series by W. L. Nelson, professor of petroleum refinery engineering, University of Tulsa

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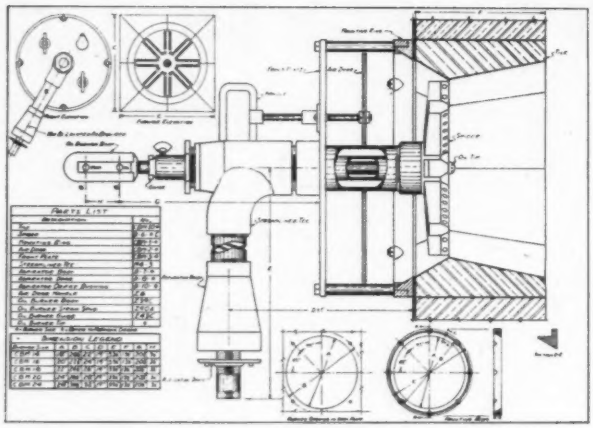

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Engineering Fundamentals

No. 239

A FEATURE OF THE OIL AND GAS JOURNAL

Surveying: Angles and Directions

A DEFLECTION angle is the angle formed by the prolongation of the last line with the line next following (Fig. 1). It has both magnitude and direction. Its magnitude may vary between 0° and 180°. Its direction is recorded as being either to the right or left depending on whether the observer must turn either to the left or right after reaching the end of one line and before starting along the course of the next line.

Suppose the deflection angles of the traverse shown in Fig. 2 are to be measured. Imagine the transit is set up over point B first. The "A" vernier of the instrument is set at zero by the upper clamp and tangent screw. With the instrument in the direct position, the vertical screw crosshair is set on point A by means of the lower clamp and tangent screw. The transit is then "plunged" by turning the telescope about the horizontal axis. This prolongs the line AB along the dashed line BF in Fig. 2. The upper motion is then released, the telescope is turned to the left, and point C is sighted using the upper clamp and tangent screw. The "A" vernier, when read in the proper direction, will give a single measure of the deflection angle at B, i.e., angle FBC. The instrument is left inverted and a second backsight is taken to point A using the lower motion. This procedure leaves

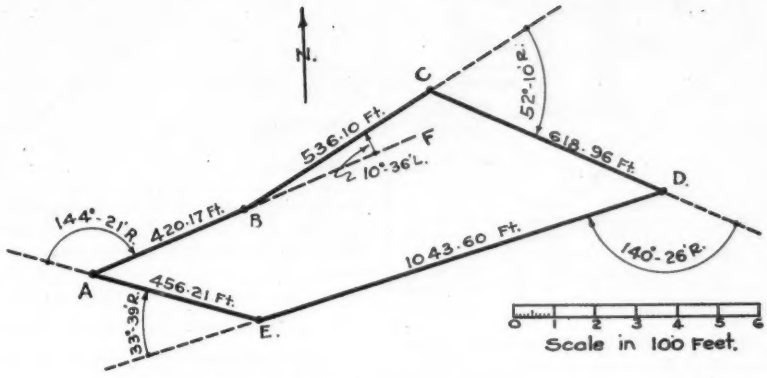

Fig. 2—Closed deflection angle traverse

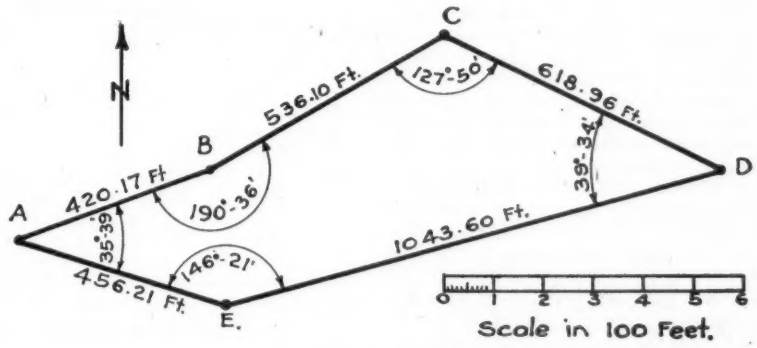

Fig. 3—Closed interior angle traverse

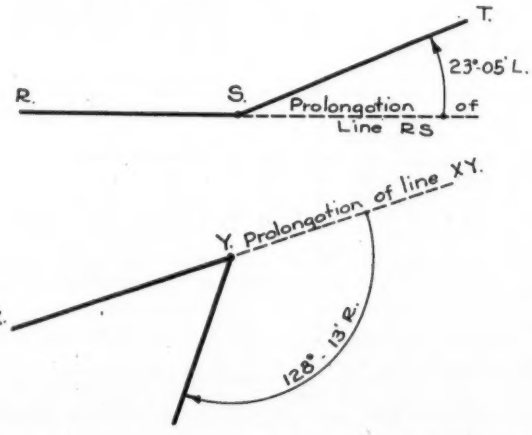

Fig. 1—(Upper) Left deflection angle; (lower) Right deflection angle

the single measurement undisturbed on the upper scale. After taking the second backsight to point A, the telescope is reinverted (placed in its normal position), the upper motion is opened, and a second foresight is taken on point C by the upper clamp and tangent screw. The angle is read, recorded as two repetitions (21° 11'), and divided by 2 to give an average value for the deflection angle at point B.

When this method is followed the average value for the deflection angle is free from instrumental errors. It also gives a more accurate measure of the angle than could be had from a single measurement, and it eliminates almost entirely the possibility of mistakes by the instrument man. The average value should check the single measurement within the least count of the instrument. The above procedure is repeated until every point of the traverse has been occupied.

Suppose the following values are those found for the traverse in Fig. 2:

Series prepared by Dr. E. A. Stephenson, head of petroleum engineering school, and Prof. D. Don Haines, department of civil engineering, University of Kansas

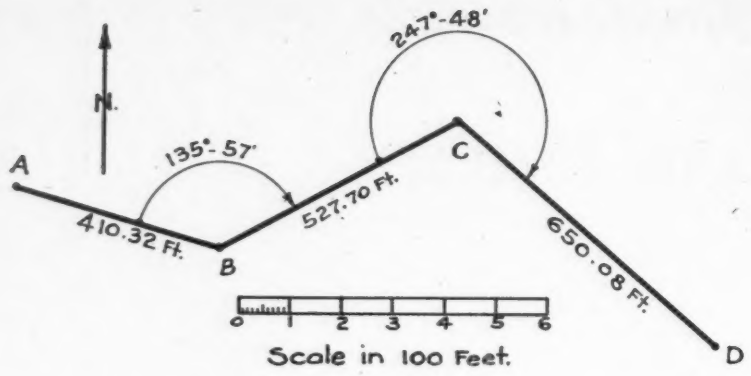

Fig. 4—Angles to the right

Point	Single measure	Two repetitions	Average
A	144° 21′ R	288° 42′	144° 21′ 00″
B	10° 36′ L	21° 11′	10° 35′ 30″
C	52° 10′ R	104° 19′	52° 09′ 30″
D	140° 26′ R	280° 54′	140° 27′ 00″
E	33° 39′ R	67° 20′	33° 40′ 00″

The single measurements as recorded above were, in this illustration, actually calculated from the azimuths as shown in Fig. 4 of the previous installment (No. 238). Similar calculations are actually made in practice. Frequently the calculations are made in reverse order. Thus, with the deflection angles measured and the azimuth of one of the lines on the traverse known, the azimuths of the remaining lines can be determined. However, before this is done the deflection angles should be "balanced." Sum of the deflection angles to the right minus the sum of the deflection angles to the left should equal 360°. The amount by which they fail to equal 360° is the angular error of closure. In the above illustration the angular error of closure is 02′ 00″ for the average angles. Such an error is allowable since it is less than the ordinarily accepted value as mentioned before. Angles should be summed up in the field immediately upon completion of the survey so as to determine the magnitude of the angular error of closure. Deflection angles are particularly convenient for either open or closed traverses of many sides and where the change in direction from line to line is small.

Interior Angles

Interior angles are usually measured on fairly regular closed traverses of few sides. An interior angle is an angle that lies wholly within an enclosed area. Its magnitude may be anywhere between 0° and 360°. Angles are measured by setting the instrument up at a traverse point and then measuring the angle at least once with the telescope direct and once with it inverted. Inversion of the telescope is necessary in order to eliminate errors of maladjustment as well as mistakes in reading. The interior angles of the traverse shown in Fig. 2 are marked in Fig. 3.

Any irregular closed figure of "n" sides can be divided into two less triangles than sides. Since there are 180° in every triangle the sum of the interior angles of a closed traverse should equal (n-2) 180°. The angles in Fig. 3 sum up to 540°, hence there is no angular error of closure.

Point	Angle
A	35° 39′
B	190° 36′
C	127° 50′
D	39° 34′
E	146° 21′
	540° 00′

Angles to the Right

Angles to the right are illustrated in Fig. 4. As seen by the figure it is simply the angular direction of a line measured in a clockwise direction from the preceding line and it can vary in size from 0° to 360°. For these reasons angles to the right are frequently called "azimuths from the back line." The method is used mostly on open traverses. The method is not particularly common in the central states area.

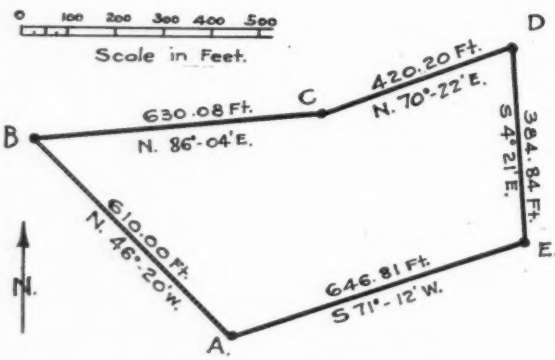

Fig. 5—Given the closed traverse ABCDEA. Problem: Calculate the forward azimuths of the lines, the deflection angles, the interior angles, and angles to the right

Example.—Fig. 5 shows lengths and true bearings of lines of the closed traverse, ABCDEA. Calculate the forward azimuths of lines, the deflection angles, the interior angles and angles to right.

Solution.—Calculations of azimuths reckoned from the south:

Az. of AB = 180° 00′ — 46° 20′ = 133° 40′
Az. of BC = 86° 04′ + 180° 00′ = 266° 04′
Az. of CD = 70° 22′ + 180° 00′ = 250° 22′
Az. of DE = 360° 00′ — 4° 21′ = 355° 39′
Az. of EA = 71° 12′ = 71° 12′

Deflection angles can be calculated most readily from azimuths when they are known. Using the azimuths as calculated above, the deflection angles in Fig. 5 are found as follows:

At point B, defl. angle = 266° 04′ — 133° 40′ = 132° 24′ R
At point C, defl. angle = 266° 04′ — 250° 22′ = 15° 42′ L
At point D, defl. angle = 355° 39′ — 250° 22′ = 105° 17′ R
At point E, defl. angle = 71° 12′ + 360° 00′ — 355° 39′ = 75° 33′ R
At point A, defl. angle = 133° 40′ — 71° 12′ = 62° 28′ R

Interior angles may be calculated from the known deflection angles. By reference to Fig. 5 it is seen that interior angles are equal to either 180° plus or minus the deflection angle.

At point A, interior angle = 180° 00′ — 62° 28′ = 117° 32′
At point B, interior angle = 180° 00′ — 132° 24′ = 47° 36′
At point C, interior angle = 180° 00′ + 15° 42′ = 195° 42′
At point D, interior angle = 180° 00′ — 105° 17′ = 74° 43′
At point E, interior angle = 180° 00′ — 75° 33′ = 104° 27′

In this illustration angles to the right can be calculated most readily by using deflection angles.

At point A, angle to the right = 180° 00′ + 62° 28′ = 242° 28′
At point B, angle to the right = 180° 00′ + 132° 24′ = 312° 24′
At point C, angle to the right = 180° 00′ — 15° 42′ = 164° 18′
At point D, angle to the right = 180° 00′ + 105° 17′ = 285° 17′
At point E, angle to the right = 180° 00′ + 75° 33′ = 255° 33′

REFINING

Baird Refining Adding Plant Improvements

BAIRD, Tex.—A construction program is now nearing completion at Baird Refining Co.'s plant here which will increase the refinery's capacity from 1,800 to 2,500 bbl. daily.

The work includes the installation of a new tower and stabilizer, and additional storage. After completion of the program, the refinery will produce approximately equal quantities of straightrun and cracked gasoline. The Baird plant obtained its crude through its 40 miles of gathering lines in Coleman County.

Gas Use in Extinguishing Gasoline Fires Studied

WASHINGTON. — Trichloromonofluoromethane—a refrigerant known commercially as Freon 11 — can be used effectively to extinguish gasoline fires and prevent explosions, according to a research report released last week by the Bureau of Mines.

The study, covering six inert gases and their effects on three different types of gasoline, was made cooperatively by the Bureau and the Mine Safety Appliances Co. Other inert gases tested and ranked in descending order of their effectiveness as flame-quenching agents were dichlorodifluoromethane (Freon 12), dichloromonofluoromethane (Freon 21), carbon dioxide, automobile-exhaust gas, and nitrogen.

Crude Supplies Located For Oklahoma Refinery

OKLAHOMA CITY. — Additional supplies of oil were found last week for the Bristow, Okla., refinery of Wilcox Oil Co., which officials earlier said was threatened with a shutdown because of the shortage of crude.

Reford Bond, chairman of the Oklahoma Corporation Commission, said three Oklahoma companies had promised to supply oil for the plant. The commission undertook to find crude for the refinery at the request of company officials and Bristow civic leaders. Bond said more oil will be found later as it is needed.

Michigan Plant Builds New $35,000 Treater

MUSKEGON, Mich.—A new Unisol treater, built with refinery labor at a cost of about $35,000, is now in operation at Old Dutch Refining Co.'s plant here.

Capacity of the unit is about 1,500 bbl. daily. Lead saving is close to 1 cc. per gallon, according to E. F. Sondregger, general manager of the plant. Ultimate plans of the refinery call for the construction of a hot clay treater, although this will not be built in the immediate future.

British American Oil Adds New Units to Refineries

TORONTO, Ont.—British American Oil Co., Ltd., is adding new equipment, costing approximately $450,000 and principally for the production of asphalt, at its Moose Jaw, Sask., and Calgary, Alta., refineries.

The company expects to have a vacuum distillation unit in operation

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at both the Moose Jaw and Calgary plants early next year. At each plant, the installation will enable processing of 6,000 to 8,000 bbl. per stream day of a wide range of heavy gravity crudes, converting the heavier fractions to penetration asphalts.

Each unit will be a conventional vacuum distillation unit and, with accessories, will cost approximately $200,000. Detailed engineering work has been done by the Koch Engineering Co., Wichita, Kans. Purchasing of materials and construction is under the supervision of British American Oil. Major items have already been purchased, according to company officials.

Although some construction yet remains to be completed, a tannin solutizer unit, a dual unit built to treat cracked gasoline and straightrun gasoline concurrently, is now in operation at the Calgary refinery. Cost approximates $45,000. Detailed engineering, purchasing, and construction was performed by British American Oil.

Lansing, Mich., Meeting Scheduled by W.P.R.A.

Refinery waste disposal and water treating problems will be discussed at the second postwar regional technical meeting of the Western Petroleum Refiners Association June 20 at the Olds Hotel in Lansing, Mich.

Refinery waste disposal will be discussed in a paper by L. C. Burroughs, Shell Oil Co., Inc. Dearborn Chemical Corp. will present a paper on water treating problems and prevention of scale formation in cooling equipment. Speaker for the second paper will be announced later.

The meeting opens at 2:30 p.m. Discussions will follow the presentation of each paper.

Continental Oil Completes Program at Wichita Falls

WICHITA FALLS, Tex.—Continental Oil Co. has completed a $500,000 streamlining and reconditioning program at its refinery here as a part of its conversion to peacetime production.

The work has brought an improved appearance and reduced maintenance costs at the plant, the company's No. 4 refinery. Included in the program was the following: Revamping the crude-heat exchange circuit for maximum throughput; revamping the naphtha tower to make a single-tower crude fractionator; installation of additional furnace tubes and a new naphtha charge pump to permit naphtha reforming; installation of a fuel-oil quench system and revamping of the pressure system equipment to handle the increased gas production.

Texaco Sets Alkylate Production Record

PORT ARTHUR, Tex.—Production of alkylate, important blending agent for high-octane aviation gasoline, has averaged 85,840 gal. daily since 1939 at The Texas Co.'s refinery here. The record production rate was revealed by M. Halpern, vice president in charge of refining.

Originally designed for 30,000 gal. daily, the alkylation unit is now producing in excess of 120,000 gal. daily.

Mid-Continent Lube Oil Inventories Decline

A 33-day supply of bright stock and a 20-day supply of viscous neutrals were held at the end of April by 13 companies manufacturing lubricating oil in the Mid-Continent area. The previous month-end inventory was 46 days' supply of bright stock and 21 days' supply of viscous neutrals.

Western Petroleum Refiners Association's summary of April operations reported production of 233,703 bbl. of bright stock and 354,271 bbl. of viscous neutrals, 70,353 bbl. of paraffin oils, 21,308 bbl. of steam refined stock, and 396,880 bbl. of blended oils. Stocks on hand April 30 were 248,075 bbl., 209,152 bbl., 74,447 bbl., 25,338 bbl., and 183,867 bbl. for these oils, respectively.

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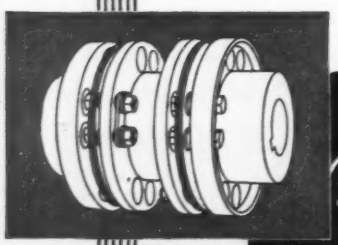

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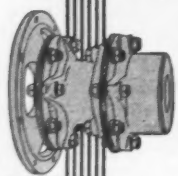

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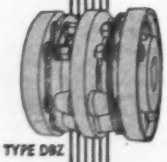

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THOMAS Flexible COUPLINGS provide for Angular and Parallel Misalignment as well as Free End Float . . . and Eliminate BACKLASH, FRICTION, WEAR and CROSS-PULL
NO LUBRICATION IS REQUIRED!

The Thomas All-Metal Coupling does not depend on springs, gears, rubber or grids to drive. All power is transmitted by direct pull.

Write for Complete Engineering Catalog!

THOMAS FLEXIBLE COUPLING CO.
WARREN, PENNSYLVANIA

Natural Gas

FPC to Resume Gas Investigation Monday

THE final and climactic hearing in Federal Power Commission's investigation of the natural gas industry, initiated nearly 2 years ago, will open Monday, June 17, in Washington.

Indications are the Washington hearing will last several weeks. In seven regional hearings during the last 9 months, the commission has accumulated 9,261 pages of testimony from 247 witnesses.

Because of its scope and possible impact on future regulation by the federal Government, the investigation has attracted widespread interest. The natural gas industry feels strongly that the results of the investigation thus far have shown that the present extent of FPC authority is adequate.

The seven regional hearings, which in the aggregate required 52 days, were held in both gas producing and consuming states. Except for Louisiana, producing states called for the movement of gas in free competition with coal and other fuels and promised to fight further extension of FPC jurisdiction. Consuming areas described their preference for gas as a fuel and told of their desire for a greater supply.

FPC's authority over natural gas is at present limited to control of interstate transmission. The industry fears the effect of an extension of its jurisdiction in either direction—either toward control of production or of the use to which gas is put by the consumer. Some producing firms in the oil industry are reported to feel at this time they will be classified as interstate utilities if they deliver gas to interstate pipe lines.

The Independent Natural Gas Association of America last week challenged the sincerity of FPC in denying it claims any jurisdiction over producing and gathering activities. Its statement came in a report of a Circuit Court of Appeals trial of a case in which the commission contended sales of Louisiana gas made by Interstate Natural Gas Co. to three other interstate transmission lines were sales in interstate commerce and subject to FPC jurisdiction.

The association said Charles E. McGee, FPC counsel, "refused to make a categorical reply" when one of the judges in the case suggested that these sales were made at the termini of Interstate's gathering lines and that, if the commission's contention were followed to its logical conclusion, a sale made at the well-mouth to an interstate transmission line would be similarly subject to FPC jurisdiction.

Arguments for FPC control over "end use" of natural gas have been based largely on a contention that gas is limited in supply and must be conserved for "superior" nonindustrial uses. Coal and railroad interests, whose markets have been taken by gas in many areas, have backed this claim.

The industry has countered this argument with testimony showing that there is a large and dependable supply of natural gas and that, to control end use, FPC must necessarily place into effect some "master plan" for control of all power sources, including oil, coal, and electrical output.

United Gas Official Urges Rejection of Tax Proposal

SHREVEPORT, La.—M. A. Abernathy, vice president of United Gas Pipe Line Co., last week called on the Louisiana State Legislature to reject the proposed five-fold increase in the Louisiana natural gas gathering tax.

Following a special prelegislative hearing on the proposal last month by the Louisiana Revenue Code Commission, two bills were introduced in the legislature, both of which would increase the gathering tax from ½ to 3 cents per 1,000 cu. ft. The bills differed principally in their allocation of the tax revenue.

Abernathy reminded the legislators, in a formal statement, that the revenue commission has disapproved the proposed tax increase by a unanimous vote. He said that, in view of the fact that the gas industry now pays 19 separate taxes to the state it "could surely not be expected to assume any further taxes."

The company official's statement praised the findings of the revenue commission in rejecting the tax. Both bills now before the legislature should be killed, he said. "The decision of the revenue code commission amounts to a mandate killing these bills which threaten to smother the whole industry."

The tax increase, advocated by P. A. Frye, state gas conservation director, as a conservation measure, encountered widespread opposition on grounds it would stifle industrial growth. Louisiana is listed as the nation's second largest gas producing state, ranking behind Texas.

Two other bills now before the legislature would place a sales tax on natural gas. One asks for a tax of 3 cents per 1,000 ft. at the well-head, and the other calls for a graduated scale depending on the price of gas at the time of the sale.

Appearing at a house ways and means committee hearing last week, Frye said he now favors the sales tax system. E. Leland Richardson, special gas attorney for the state, backed Frye, asserting a gas-gathering tax was difficult to enforce.

Northern Natural Program Gets FPC Approval

WASHINGTON.—The Federal Power Commission last week authorized a construction program for Northern Natural Gas Co. involving some 265 miles of pipe line, new compressor stations, additional compressor units, and other facilities in its system extending service to new communities in Nebraska, Iowa, and Minnesota. Estimated cost is $7,886,076.

Major portion of the pipe-line construction consists of looping existing lines, including construction of about 156 miles of 24-in. line, 11½ miles of 20-in. line, 40 miles of 18-in. and 6½ miles of 12¾-in. pipe line, the latter to connect the South St. Paul and St. Paul, Minn., border stations. The various loop lines will increase capacity between compressor stations. An additional 50 miles of 20 and 24-in. pipe lines was authorized to meet winter demands on the system.

New compressor stations involved are a 450-hp. unit near Otis, Kans., and a 2,400-hp. station near Cherokee, Iowa. Capacity at existing stations will be increased by the installation of two 1,000-hp. units at the Sublette, Kans., station; a 900-hp. unit at Oakland, Iowa, and an 800-hp. unit at the South Sioux City, Neb., station.

April Natural Gas Sales Show 2.2 Per Cent Drop

NEW YORK.—April sales of natural gas were off 2.2 per cent, according to the American Gas Association which stated that the decrease showed April 1945 sales of 1,952,253,000 therms compared with 1,909,336,000 therms for April of this year. The association's natural gas index for April was 176.7 (1935-39=100).

For the 12 months ended April 30, 1946, natural gas sales to ultimate consumers were estimated to be 21,878,035,000 therms, compared with 22,500,023,000 therms for the same period in 1945, a decrease of 2.8 per cent.

One therm equals about 100 cu. ft. of natural gas.

STATISTICS and

WEEKLY WELL COMPLETIONS . . . WEEK ENDED JUNE 8, 1946

	Total of all wells					Cum. to date		Wildcat completions and discoveries					Cumulative total, 1946				
	Comp.	Oil	Gas	Dry	Footage	1946	1945	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
New York	32	16	0	‡16	48,211	683	561	0	0	0	0	0	0	0	0	0	0
Pennsylvania	77	38	3	§36	118,204	1,752	1,637	0	0	0	0	0	0	0	0	0	0
West Virginia	16	1	12	3	51,346	298	335	0	0	0	0	0	0	0	0	0	0
Ohio	21	4	9	8	56,330	492	354	0	0	0	0	0	2	0	10	17	29
Indiana	0	0	0	0	0	130	75	0	0	0	0	0	1	0	0	8	9
Kentucky	14	8	4	2	23,369	195	176	0	0	0	0	0	2	0	0	15	17
Illinois	31	19	0	12	75,403	887	694	0	0	0	6	6	17	0	0	153	170
Michigan	19	3	7	9	35,545	327	325	1	0	1	3	5	9	0	4	102	115
Kansas	46	22	8	16	148,624	857	685	0	0	0	8	8	13	0	3	105	121
Neb., Mo., Iowa	1	0	0	1	2,344	8	12	0	0	0	0	0	0	0	0	4	4
Oklahoma	42	25	1	16	132,649	1,001	1,029	1	0	0	0	1	30	0	16	120	166
Texas	170	106	12	52	735,667	3,497	3,114	3	0	1	23	27	87	17	10	546	660
North Central	64	33	1	*30	142,336	1,247	889	1	0	0	10	11	24	0	0	221	245
West	41	36	1	4	231,094	727	836	0	0	1	3	4	23	0	1	76	100
Panhandle	10	2	5	†3	28,514	158	233	0	0	0	0	0	0	0	0	5	5
Eastern	15	12	2	1	74,984	329	133	1	0	0	0	1	10	0	1	41	52
Gulf Coast	32	17	3	12	216,249	786	733	0	0	0	9	9	22	15	4	119	160
Southwest	8	6	0	2	42,490	250	290	1	0	0	1	2	8	2	4	84	98
Louisiana	24	16	3	5	140,678	579	431	0	0	0	2	2	28	5	3	74	110
Northern	15	8	3	4	69,646	311	141	0	0	0	1	1	5	0	0	43	48
Southern	9	8	0	1	71,032	268	290	0	0	0	1	1	23	5	3	31	62
Arkansas	3	2	0	1	8,725	76	75	0	0	0	1	1	3	0	0	13	16
Mississippi	7	5	0	2	47,555	105	154	0	0	0	1	1	1	0	1	24	26
Southeastern States	0	0	0	0	0	18	22	0	0	0	0	0	0	0	0	15	15
Montana	7	2	2	3	13,308	117	138	0	0	0	2	2	6	0	0	13	19
Wyoming	6	6	0	0	27,147	75	84	0	0	0	0	0	8	0	3	20	31
Colorado-Utah	1	1	0	0	6,349	51	14	0	0	0	0	0	3	0	0	8	11
New Mexico	6	5	1	0	23,372	155	204	1	0	0	0	1	3	0	0	19	22
California	45	36	2	7	178,723	795	1,013	0	0	0	6	6	4	0	2	100	106
Total United States	568	315	64	189	1,873,549	12,098	11,132	6	0	2	52	60	217	22	52	1,356	1,647
Total previous week	503	258	46	199	1,561,517	11,530	10,607	13	3	4	61	81	211	25	50	1,304	1,590
Total June 9, 1945	525	299	41	185	1,907,003	11,132	9,634	7	1	3	67	78	245	9	58	1,420	1,732

Service wells included: *1, †2, ‡16, §34.

MARKET QUOTATIONS

(Quotations on other products than those shown here furnished on request. Quotations are f.o.b. plant in tank cars and in cents per gal. as of last Monday.)

REFINERY GASOLINE

Octane (A.S.T.M.)	78-80†	73-75
Mid-Continent*	6.375-6.750	5.625-6.000
Texas Gulf Coast	6.375	5.750
New York Harbor	7.375	6.375
California		6.00-6.875

*Basic Oklahoma Group 3. †1939 C.F.R. (research method).

NATURAL GASOLINE

Grades:	26-70	18-55
Oklahoma (Group 3)	3.250	3.900
N. Texas (f.o.b. plant)	2.750	3.300
N. Louisiana (f.o.b. plant)	3.125	3.750
California	4.875	5.500

CRUDE-OIL PRICES

Representative posted schedules per bbl.	
East Texas	$1.35
Conroe	1.53
Tepetate, Louisiana, avg. grav.	1.30
Illinois Basin	1.47
Pecos County, Texas	1.05
Bradford, Pennsylvania	3.10
Van, Van Zandt County, Texas	1.18

Note: Exclusive of subsidy.

GRAVITY SCHEDULES

Top prices include all gravities above grades designated, and low prices include all gravities below grades designated:

Gravity—	Signal Hill, Calif.	Oklahoma, Kansas	Gulf Coast Texas	West Tex.*
18-18.9	$0.90	....	....	....
19-19.9	.94	....	$1.16	$0.80
20-20.9	.98	$0.95	1.18	.82
21-21.9	1.02	.97	1.20	.84
22-22.9	1.06	.99	1.22	.86
23-23.9	1.10	1.01	1.24	.88
24-24.9	1.13	1.03	1.26	.90
25-25.9	1.17	1.05	1.28	.92
26-26.9	1.21	1.07	1.30	.94
27-27.9	1.25	1.09	1.32	.96
28-28.9	1.28	1.11	1.34	.98
29-29.9	1.30	1.13	1.36	1.00
30-30.9	1.33	1.15	1.38	1.02
31-31.9	....	1.17	1.40	1.04
32-32.9	....	1.19	1.42	1.06
33-33.9	....	1.21	1.44	1.08
34-34.9	....	1.23	1.46	1.10
35-35.9	....	1.25	1.48	1.12
36-36.9	....	1.27	1.50	1.14
37-37.9	....	1.29	1.52	1.16
38-38.9	....	1.31	1.54	1.18
39-39.9	....	1.33	1.56	1.20
40 and above	....	1.35	1.58	1.22

*Includes Lea County, New Mexico.

A.P.I. REFINERY REPORT

Week ended June 1.
(Figures in thousands of barrels)

	Dly. crude runs to stills	Stocks Gasoline	Distillate	Residual
East Coast	771	22,922	9,920	8,052
Appalachian	159	3,619	569	380
Ill., Ind., Ky.	786	19,838	4,508	3,467
Okla., Kans., Mo.	379	8,353	1,869	1,248
Inland Texas	234	3,028	319	705
Tex. Gif. Cst.	1,165	14,249	5,205	5,135
La. Gulf Cst.	350	3,870	1,676	1,332
N. La., Ark.	58	1,698	490	225
Rocky Mtn.	135	2,307	442	873
California	806	15,363	8,042	23,027
Total 6-1-46	4,843	95,247	33,040	44,408
Total 5-25-46	4,857	95,769	32,973	43,368
Total 6-2-45	4,862	88,275	29,608	39,456

CRUDE-OIL STOCKS

(Bureau of Mines Estimate)

Week ended:	Barrels of Crude*
June 1, 1946	220,885,000
May 25, 1946	222,214,000
June 2, 1945	224,079,000

*Excludes unrefinable Calif. stocks.

TRENDS

DAILY AVERAGE PRODUCTION FOR WEEK

	June 8 crude oil	B. of M. June demand	June 1 crude oil
Alabama	1,150	750	1,200
Arkansas	79,250	79,000	78,450
California	867,450	848,000	860,350
Colorado	29,930	26,000	28,770
Eastern	68,200	64,200	62,900
Florida	250	250	250
Illinois	207,700	210,000	211,800
Indiana	20,900	18,000	19,850
Kansas	239,450	255,000	263,850
Kentucky	31,000	31,000	30,500
Louisiana	379,750	380,000	380,150
North Louisiana	89,650	.....	88,700
South Louisiana	290,100	.....	291,450
Michigan	47,420	46,000	45,550
Mississippi	64,350	57,000	64,950
Montana	23,010	22,000	23,650
Nebraska	750	800	750
New Mexico	97,600	98,000	95,300
Oklahoma	385,000	380,000	378,750
Texas	2,261,500	2,050,000	2,114,800
East Texas	326,000	.....	388,800
East Central Texas	151,300	.....	139,600
North Central Texas	193,250	.....	164,800
Texas Panhandle	86,450	.....	83,000
West Texas	584,200	.....	521,100
Southwest Texas	404,900	.....	331,500
Texas Gulf Coast	515,400	.....	486,000
Wyoming	105,510	104,000	106,190
Total United States	*4,910,170	4,670,000	4,768,010
Change from previous week	up 142,160		

Total production January 1-June 8 ..... 745,995,199 bbl.
Same period last year (crude, plus condensate) .. 760,583,950 bbl.

*Not incl. 26,200 bbl. condensate. †Incl. 4,058,200 bbl. condensate. Texas divisions revised to follow R.R. Comm. dist. boundaries.

CRUDE OIL STOCKS 220,885,000 bbl. as of June 1—down 1,329,000 bbl. One year ago 224,079,000 bbl.

GASOLINE STOCKS 95,247,000 bbl. as of June 1—down 522,000 bbl. One year ago 88,275,000 bbl.

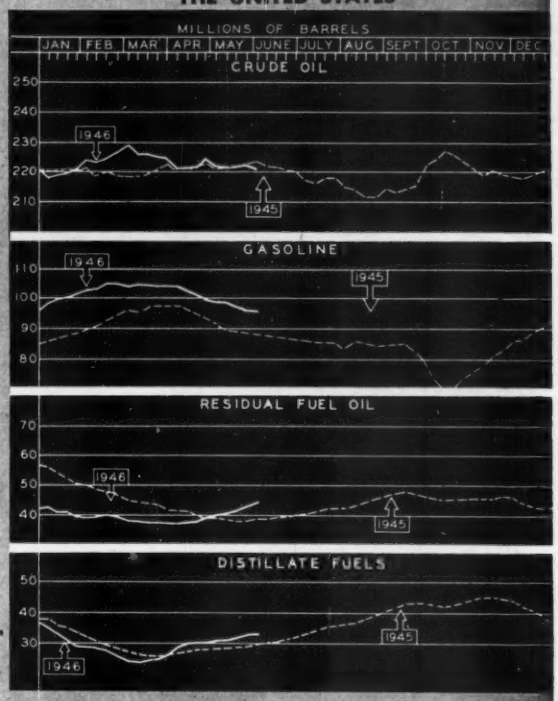
RESIDUAL FUEL-OIL STOCKS 44,408,000 bbl. as of June 1—up 1,040,000 bbl. One year ago 39,456,000 bbl.

GAS OIL AND DISTILLATE STOCKS 33,040,000 bbl. as of June 1—up 67,000 bbl. One year ago 29,608,000 bbl.

CRUDE-OIL PRODUCTION 4,910,170 bbl. as of June 8—up 142,160 bbl. One year ago 4,851,050 bbl.

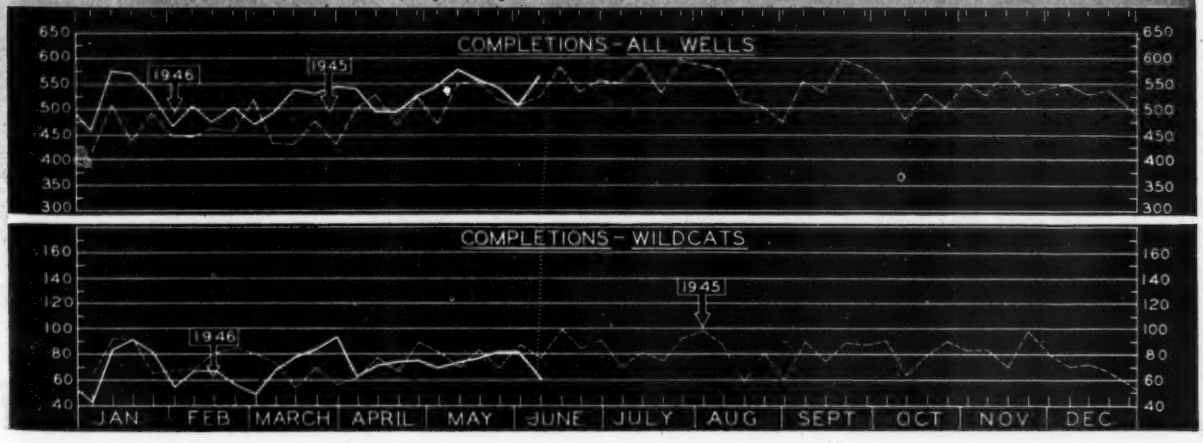
REFINERY RUNS 4,843,000 bbl. daily week ended June 1—down 14,000 bbl. One year ago 4,862,000 bbl.

OIL STOCKS IN THE UNITED STATES



DAILY OPERATIONS

Solid line charts weekly completions, service wells in Eastern area included



Both are tough . . . but ONE is tougher!

WHEN TWO barnyard cocks start out to settle their differences, one thing is certain—they can't both win. Both may be plenty tough . . . but one will be tougher.

MOST WIRE ROPES are tough, too, but some are tougher than others. Rochester wire ropes, we believe, stand up longer in the battle against wear, tear and strain.

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Layne Vertical Turbine pumps are available in sizes to produce from 40 to 16,000 gallons of water per minute. High efficiency saves hundreds of dollars on power cost per year.

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LAYNE

WELL WATER SYSTEMS
VERTICAL TURBINE PUMPS

PIPE LINES

Colorado Interstate Gas Co. Opens New Station

COLORADO INTERSTATE GAS CO. has placed in operation a new 3,200-hp. compressor station on a 55-acre tract 15 miles north of Colorado Springs.

Last station on the pipe line system between Clayton, N. M., and Denver, the installation forms a major part of an expansion program which consists of additional compressors at four other Colorado Interstate stations and two in the Texas Panhandle for its associate company, Canadian River Gas Co. Enlargement of compressor facilities at the six existing stations accounted for 7,800 of the 11,000 hp. added under the expansion program.

Compressors for the new station were furnished by Clark Brothers and are their RA-8 800 hp. angle-type, using four compressor cylinders per engine. All compressors are mounted on a common concrete mat 114 ft. long and 18 in. thick.

The compressor building is 118 ft. long, 32 ft. wide and 28 ft. high, with full basement. The auxiliary building, housing generators, electrical equipment, boilers, change-room, and a small shop, is 61 ft. long, 37 ft. wide, and 18 ft. high. Other buildings at the compressor plant consist of the meter building, cooler building, two well houses, and the office and warehouse.

All buildings are of the same type and are constructed of celotex encased in metal. This type of construction affords a tight building with heat transfer qualities equivalent to 8 in. of brick. All roofs are of the Pratt-truss type, having a slope of 1 in. in 12 in., with steel decking and tar and gravel waterproofing.

Because only a relatively small quantity of water was found at the station site, the cooling system was given special attention in design. The cooling water for the power cylinders is cooled by means of a fin-fan unit having four-fin cooling sections and two 30-hp. two-speed motors driving 10-ft. fans. The fans are the forced-draft type, rotating in a horizontal plane.

Water from the cooling units to the engines is automatically controlled by means of a recorder controller actuating a bypass butterfly valve. Should the temperature out of the fin-fan unit fall too low, four Mercoid switches automatically change the speed of the fans. In extremely cold weather, this is desirable because the units could freeze if not automatically protected.

The cooling water for the oil coolers is handled through two Carrier units, which make use of evaporative cooling. Each unit has its own spray pump and induced-draft fan. The temperature from these units to the cooler is automatically maintained by a recorder controller which controls the dampers in the fan inlet and discharge. By means of this cooling system, plant water consumption will be approximately 10 g.p.m., including continuous blow-down from the Carrier units. The pumping system consists of vertical pumps in a concrete sump near the center of operations.

All power for the plant is generated by two Worthington BBG-6 generators. The power is generated at

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"BITUMASTIC" HOT APPLIED PIPE LINE COATING

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Cut & Bevel Any Pipe
With
Maximum SPEED
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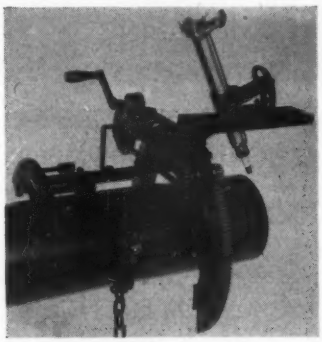

The H & M PIPE CUTTING and BEVELING MACHINE

SPEED: Complete cut and bevel can be made on 12 inch pipe in about 2 minutes.

ECONOMY: Save approximately one-half labor and gas costs.

PORTABILITY: Can easily be carried from one pipe section to another.

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PIPE LINE SPECIALISTS

220 volts and stepped down to 110 volts for lighting. Lighting standby power is available at 110 volts, with a switching arrangement which makes it possible to synchronize the two systems.

Besides the new compressor station, largest unit of the expansion program, there were these installations at the six other stations on the Amarillo-Denver line:

Bevins, Tex., three 600-hp. Clark Brothers compressors; Dalhart, Tex., two 600-hp. Clark Brothers compressors; Clayton, N. M., one 800-hp. Worthington compressor; Cimarron, N. M., one 800-hp. Worthington compressor; Canon, Colo., two 800-hp. Clark compressors; Divine, Colo., one 800-hp. Worthington compressor.

The new station was designed and constructed by the Stearns-Roger Manufacturing Co., Denver, which also made the additional installations at the six existing plants. Stearns-Roger staff in charge of designing, construction, and installation consisted of A. G. Asbury, resident engineer; A. F. Smith, project manager; W. H. Gontz, assistant project manager; Al Gosnell, administrative, and W. R. Casey, general superintendent.

G. D. Edwards supervised construction and installation at the new station for Interstate, and is superintendent.

Interstate Award Given For Accident-Free Record

Long periods of accident-free operation at two Louisiana installations was the basis of the award of the Joseph A. Holmes safety certificates to two units of Interstate Oil Pipe Line Co.

The company announced last week the installations were the Melville, La., crude pumping station which was operated from August 26, 1926, to December 31, 1945 without a lost-time accident, and the Bunkie, La., station, operated without a lost-time accident from July 1, 1927, to December 31, 1945, a total of 730,666 manhours.

Pan American Pipe Line Buys East Texas System

HOUSTON.—Pan American Pipe Line Co. has completed arrangements for the purchase of Central Pipe Line Co.'s trunk line from the Quitman field, Wood County, Texas, to the East Texas field and the gathering system in Quitman.

The trunk line is composed of some 45 miles of 4, 5, and 6-in. line, and there are approximately 20 miles of gathering lines in the Quitman field, according to Pan American's announcement last week. Pump stations are located at Quitman, Hainesville, Hawkins, and Gladewater.

Pan American will take over operations of the system July 1, and its affiliate, Pan American Production Co., will become the crude purchaser in the Quitman field as of that date.

As quickly as pipe and other materials can be obtained, the system will be revamped and improved to an extent that will approximately double its capacity and tie into Pan American's East Texas-Houston-Texas City main trunk line, Pan American said.

Pipe Lines Being Laid To New Kentucky Pool

LOUISVILLE, Ky.—Southern Pipe Line Co. of Illinois and Ashland Oil & Refining Co. are laying pipe lines 45 to 50 miles eastward from a new oil pool, six miles northwest of Albany in Clinton County, Kentucky.

The new lines will extend to a railroad terminal at Burnside, Ky. The first strike was made in the shallow pool several weeks ago, and the area has since become the center of oil activity in eastern Kentucky. Some observers believe daily production from the pool may reach 5,000 bbl. or better.

PIPELINE "Know-how"

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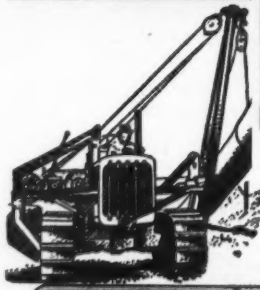
General Office Manager

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Exploration and Drilling

Is Delhi Only the First of Many?

WITH production approaching the 15,000-bbl.-daily mark, the Delhi area, on the flanks of the Greater Monroe uplift in northern Louisiana, seems to have lived up thus far to some of the optimistic anticipations that greeted its discovery some 18 months ago. Therefore, additional potentialities, which a year and a half ago might have been considered imagination stretchers, may now be considered as fairly reasonable hopes.

The production is coming from a pinchout stratigraphic trap against the uplift, but the producing area represents only one small sector of the circle around the whole regional uplift. The big question, therefore, is what are the prospects of finding the same conditions at other points around the uplift. The answer, thus far, seems to be that there is nothing in the known facts about the stratigraphic section, or the over-all sedimentary environment at most other points to preclude the accumulation of oil on any side of the regional uplift.

It is a perfectly safe bet that a great many geologists are examining the logs of all the available wells from the top of the uplift to points downdip on the flanks, identifying the various formations as they come into the section down the flank. Careful correlation of formations, determinations of regional dips, and preparation of isopach maps to check thickening, are definitely in order as steps in such a campaign. The objective is to estimate the surface location of the probable subsurface pinchouts against the flanks of the uplift.

The risks are obvious. The task is to determine the surface location of a belt around the uplift, where certain subsurface conditions can be expected. However, one school of geologists figures the odds are not as great as might be supposed, because of a belief that it is not going to be necessary to hit exactly the same stratigraphic pinchout as that at Delhi.

They reason that there were numerous periods during which there was deposition of sand at a reasonable distance from the prevailing shore line of the period. Consequently they do not believe that there is only one sand section in the Tuscaloosa to shoot for. If their theory should prove true, the net result may be the finding of good sand reservoirs at progressively greater depths as drilling moves away from the uplift. On this basis, the Delhi area would be only the first and shallowest of a possible series of deeper and deeper fields, moving away from the uplift.

Since potentially this condition could exist on all sides of the uplift, these geologists reason that in drilling for a belt to hit a pinchout, they do not have to hit one narrow belt around the uplift, but have a chance to hit any one of several belts at different depths, and have this chance at numerous points around the regional uplift. If true, this would add considerably to the chances of any given wildcat finding a new field.

SOUTHWEST TEXAS

Starr County Discovery Gages 147 Bbl. Daily

CORPUS CHRISTI.—W. H. Holland 1 Roos-Bennett, new discovery well in southeastern Starr County, between the Boyle and Garcia fields of that county, gaged 147 bbl. of oil per day through a ¼-in. choke, 26°-gravity oil with 225-lb. tubing and 925-lb. casing pressure. Production is through perforations at 2,961-67 ft. Total depth is 3,406 ft. with 5½-in. casing set to 3,032 ft.

Haynes B. Ownby Drilling Co. 1 Vicenta Gonzales, blowout well approximately 1½ miles southeast of the shallow Armagosa gas field and about 10 miles northwest of Alice, in Jim Wells County, is reported to have flowed gas and 56°-gravity condensate with 2,100-lb. shut-in pressure, and 1,200 lb. working pressure through a 3/16-in. choke, from total depth of 6,800 ft. Drill-pipe was lodged in the hole when it was bridged over, enabling operators to bring the hole under control. This well is located in the La Tinaja de Lara grant.

United North and South Development 1 Webb, a wildcat 4½ miles southwest of Luling, in Guadalupe County, has set casing and is testing saturation encountered at 2,420-85 ft. in Serpentine, and at 2,510-25 ft. in the Austin chalk. Total depth is 2,525 ft. Test is located in the James Hodges Survey.

C. W. Voyles 1 C. L. Moncure Estate, wildcat in Bastrop County, 4 miles southwest of Bastrop Townsite, recovered 170 ft. of mud cut with oil and gas on drill-stem test at 3,480-83 ft., with 425-lb. bottom-hole pressure flowing and 850-lb. shut-in pressure. Total depth is 3,483 ft. in Edwards lime. Oil show was indicated at 3,480 ft. on electrical log. Operators are preparing to set pipe.

Twenty-three new locations were reported this week, including nine wildcats, one each in Brooks, Dimmit, Duval, Jim Hogg, McMullen, San Patricio, Webb, Williamson, and Zapata counties. One new oil pool was opened in Starr County while four wildcats were dry, one each in Jim Hogg, Jim Wells, Live Oak, and McMullen counties. Jim Wells and Starr counties each received three completions to take the lead this week, with Duval, Karnes, Refugio next with two completions each.

SOUTHWEST TEXAS SUCCESSFUL WILDCAT

Starr County: New oil pool—W. H. Holland 1 Roos-Bennett, Share 100, Porcion 93, 12 mi. NE Rio Grande City, top pay 2,959 ft., TD 3,434 ft., perf. 2,961-67 ft. PT 147 bbl. daily., ¼-in. choke, gas-oil ratio 600 to 1, TP 225 lb., CP 925 lb., gravity 24, no water.

SOUTHWEST TEXAS WILDCAT FAILURES

Jim Hogg County: Humble 5-B Mestena O&G Co., Palitos Blancos Grant, 13½ mi. S Hebbronville, dry, TD 5,672 ft.

Jim Wells County: Magnolia 1 Boerjan Unit, Lot 10, Blk. 12, lands adjoining Townsite of La Gloria, 2 mi. E La Gloria field, dry, TD 8,850 ft.

Live Oak County: Herman Bros. et al 1 H. Wieding, R. Triplett Sur. 151, 3½ mi. NE of Oakville field, dry, TD 7,011 ft.

McMullen County: Stanolind 1 E. M. Henry, Noah Scott Sur., 5 mi. NW Tilden, dry, TD 6,528 ft.

APPALACHIAN FIELD

Large Gas Wells Feature West Virginia Completions

PITTSBURGH.—In Ripley district, Jackson County, West Virginia, Aileen Oil and Gas Co. completed the wildcat on Perry Hickman farm good for 6,000,000 cu. ft. gas natural, from the Oriskany sand. The Corniferous lime was logged at 4,889 ft.; Oriskany 4,991 ft.; gas 4,992-5,004 ft., and total depth 5,011 ft.

In Ravenswood district, Jackson County, Spartan Gas Co. completed S79 J. E. Hertje with a final gage of 2,588,000 cu. ft. gas from the Oriskany with the Corniferous lime at 4,743 ft.; Oriskany 4,849 ft.; show oil in Corniferous at 4,779 ft., and total depth 4,887 ft.

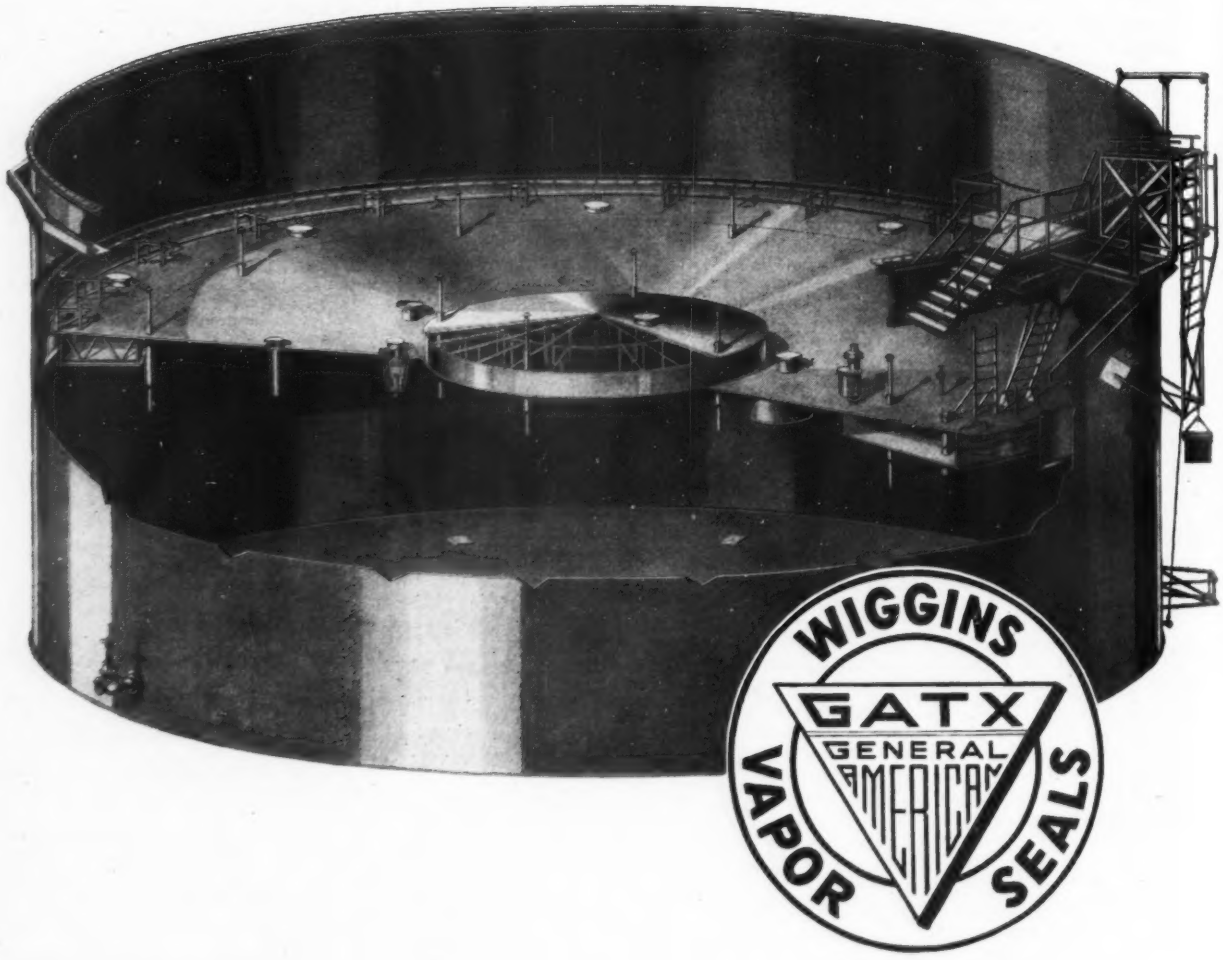
In Baileysville district Wyoming County, United Producing Co. completed 1,333 W. M. Ritter Lumber Co. with a gage of 3,011,000 cu. ft. gas after shooting the Berea. The Berea was placed at 3,477-3,511 ft., with gas at 3,490-3,506 ft. gaging natural 1,104,000 cu. ft. Total depth was 3,512 ft.

New locations in West Virginia totaled 19 and were located in Greenbrier, Lincoln, Logan, Mingo, McDowell, Nicholas, Ohio, Raleigh, Ritchie, Roane, Wayne, Wirt, and Wood counties.

In southwestern Pennsylvania, new locations totaled 5 and were located in Kittanning and Red Bank townships, Armstrong County; Clover Township, Jefferson County, and North Strabane Township, Washington County.

The HIDEK

An Old Standard



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PERMIAN BASIN

New Ellenburger Area Opened in Ector County

MIDLAND.—A new Ellenburger area has been opened in northwestern Ector at The Texas Co. 1-F Fraser, Section 39, Block 45, T-1-N, T&P Survey, 2 miles north of the TXL Ellenburger area and the same distance southwest from the San Andres production in the Goldsmith pool.

On a 115-minute drill-stem test from 9,733-9,800 ft. gas came to the surface in 9 minutes, mud in 24 minutes, oil-cut mud in 26 minutes and clean mud in 35 minutes. During the next hour, the well flowed 66 bbl. of 42°-gravity oil, cut only 0.2 per cent with mud. Gas-oil ratio was 1,100 to 1. Electrical survey will be run, and operator will drill ahead.

Cities Service Oil Co. 1 Parker, Section 20, Block 44, T-2-S, T&P Survey, deep wildcat 1¼ miles west of the Harper (San Andres) pool, Ector County, ran a 100-minute drill-stem test at 11,525-610 ft. in the Upper Ordovician. There was a faint blow of air at the start, exhausting in 85 minutes. Final recovery was only 10 ft. of drilling mud. It was drilling below 11,650 ft. in lime.

Shell Oil Co., Inc., and The Texas Co. 2 Ratliff & Bedford, Section 4, Block 73, Public School Lands, southeast offset to the discovery of the Bedford pool of southwestern Andrews County, has been dually completed from the Devonian and Ellenburger. It made 243 bbl. of 42.3°-gravity oil daily from 8,757-9,170 ft. in the Devonian. From the Ellenburger from 11,015-330 ft. it made 500 bbl. oil daily.

The Atlantic Oil & Refining Co. 1-D-11 University, Section 2, Block 11, University Lands, slightly more than 1 mile south of the Martin field in southwestern Andrews, retreated the lower Permian with 5,000 gal. of acid through perforations from 7,804-69 ft. It flowed at the rate of 11 bbl. hourly through ¼-in. choke. Oil was cut 5 per cent by basic sediment and water, 5.1 per cent by salt water. Tubing pressure was 200 lb. Skelly Oil Co. 1-Z University, Section 10, Block 11, University Lands, wildcat south of the Martin pool, was running a drill-stem test from 7,624-29 ft.

Argo Oil Corp. 1 Dora Roberts, Section 294, Block 13, H&GN Survey, Reeves County prospect, 13 miles northeast of Balmorhea, ran a 4-hour drill-stem test from 11,097-11,205 ft. Recovery was 3,000-ft. water blanket and 3,510 ft. of mud slightly cut with oil and gas in the bottom 240 ft. Operator was drilling up a packer rubber.

Humble Oil & Refining Co. 1 Pio Crespi, Section 19, Block 38, T-2-S, T&P Survey, 1 mile north of the Midland pool in Midland County, reacidized with 2,000 gal. from 11,420-50 ft. and 11,470-11,540 ft. Operator swabbed off oil load and acid residue, swabbing 2 to 3 bbl. of fluid per hour through 2-in. tubing, 10 per cent oil and 90 per cent water, origin undetermined.

Welch pool, Dawson County, had six completions this week, TXL-Devonian, Ector County, and Keystone-Ellenburger, Winkler County, each four and Block 31 field, Crane County, and Howard-Glasscock field, Howard County, each three, Keystone-Ellenburger field had four locations, TXL field three and Welch field two. TXL field has 39 drilling wells; Keystone-Ellenburger field 24; Fullerton field, Andrews County, 23; Block 31 field 13; Welch field 11 and Martin field, Andrews County, 8.

WEST TEXAS SUCCESSFUL WILDCAT

Sutton County: New gas field—Shell 1 Duke Wilson et al, Sec. 38, Blk. 14, TW&NG Sur., 19 mi. SE Sonora, elev. 2,233 ft., flowed 9,200,000 cu. ft. gas through open 2-in. tubing, perf. 4,195-4,215 ft. and 4,220-45 ft. Strawn, TD 6,170 ft.

WEST TEXAS WILDCAT FAILURES

Crane County: Atlantic 1-V-31 University, Sec. 26, Blk. 31, Univ. lds., 1 mi. E Block 31 pool, elev. 2,583 ft., dry, TD 3,550 ft.

Hudspeth County: A. R. Jones Co. 1 E. C. Mowry, Sec. 36, Blk. 70, T-2-S, T&P Sur., 12 mi. NW Salt Flat, elev. 4,035 ft., Bone Springs 1,240 ft., Wolfcamp 1,956 ft., dry, TD 4,519 ft.

Sterling County: R. R. Herrell 1 TXL, Sec. 1, Blk. 31, T-5-S, T&P Sur., 14½ mi. SW Sterling City, elev. 2,567 ft., San Andres 1,720 ft., Clear Fork 2,400 ft., dry, TD 2,457 ft.

SOUTHEASTERN NEW MEXICO

HOBBS.—Humble Oil & Refining Co. 1-B Federal Leonard, 12-26s-37e, Ellenburger test ¼ mile north of the discovery in eastern Lea County, has passed 11,701 ft. in Simpson lime and shale. It topped the Simpson low at 11,185 ft., 8,170 ft. below sea level, and has some distance to go before expecting the Ellenburger.

Fred Turner 1-D State, 5-17s-36e extension to the west Lovington field, with total depth of 5,140 ft. was preparing to acidize. The well swabbed naturally 10 bbl. of oil daily. The Texas Co. 4 Blineberry, 20-22s-38e, near the lower Permian production in the Drinkard field, missed that pay zone. It was making hole below 7,710 ft. and will continue until it finds oil, gas, water or granite.

D. C. DeVito 1 State, 19-23s-26e, southwestern Eddy County wildcat, was drilling at 2,436 ft. in lime near the base of the Bell Canyon section. It was said to be checking slightly higher than some nearby dry holes that had oil shows in a slightly deeper section.

Square Lake field, Eddy County, had two completions this week, and Empire field, Eddy County, and Maljamar field, Lea County, each had one. Square Lake field had four locations and Fren field, Eddy County, and Brunson field, Lea County, each had two. Caprock field, Chaves & Lea

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counties, has 24 drilling wells; Drinkard field, Lea County, 16; Square Lake field, 14; Grayburg-Jackson field, Eddy County, 12; and Paddock field, Lea County, six.

SOUTHEASTERN NEW MEXICO SUCCESSFUL WILDCAT

Lea County: New oil pay—Continental 4-B-23 Skaggs, 23-20s-37e, Skaggs Deep field, elev. 3,531 ft., flowed 111 bbl. day through open tubing, perf. 6,760-6,840 ft. Clear Fork, gravity 37°, TD 7,900 ft.

CALIFORNIA

California Operators May Consider Production Cut

LOS ANGELES.—With crude and refined oil stocks increasing again, some consideration may be given to reducing production to the maximum efficient rate in several California fields. First indication of stock accumulations came during April, and this has continued. This accumulation may be retarded during the summer months, but, if production continues at the current rate, 1946 will show an addition to stocks for the first time since 1941. Exploitation of the 237 zone is continuing in Wilmington field. The latest completion is Termo Co.'s 1-D which was finished flowing 2,900 bbl. of clean 30.1°-gravity oil and 2,000,000 cu. ft. of gas daily through a 36/64-in. bean.

The joint test of Richfield, Shell, Standard, Texas, Tide Water Associated, and Union Oil in the area between Playa Del Rey and El Segundo on fee-owned acreage is making footage again after a delay of several days due to stuck drill pipe. The region consists of a series of rolling hills of low elevation not exceeding 100 ft. There is, however, a deep trough between the present test and one drilled some time ago by the Pauley interests on the Hyperion sewer farm about ½ mile to the southwest. Shell Oil Co., Inc., was selected as the operator some time ago, and drilling contract was awarded to the Rocky Mountain Drilling Co. which is using a portable mast and equipment. This acreage was purchased in fee back in 1937 as a joint undertaking.

Richfield should have three new wells ready for production tests in the East Los Angeles field soon. Two have been given formation tests and came up to expectations, although one, 1 Keller in section 9-2s-12w, showed water in the upper zone. The first well on the Edison right-of-way showed a flow of 1,215 bbl. of clean 36°-gravity oil and 1,500,000 cu. ft. of gas on a formation test and plans were immediately started to land pipe and complete. This field shows every indication of proving to be one of major importance from a production standpoint. The Southern California Edison Co. has power-line rights-of-way through two fields, Wilmington and East Los Angeles. Because of the power lines, wells are started from surface locations several hundred feet away and the bottom of the holes placed beneath the right-of-way by directional drilling.

Tide Water Associated completed an excellent well in the Ventura Avenue field this week when 21 McGonigle was finished flowing at a daily rate of 3,544 bbl. through a 36/64-in. bean for 5 hours before being cut back. Through a 24/64-in. bean the well flowed 2,577 bbl. of clean 29.7°-gravity oil and 1,908,000 cu. ft. of gas from the D-7 zone. Drilling operations were concluded at 12,557 ft. and 6⅝-in. casing cemented at 11,250 ft, A blank 4½-in. liner was then landed at 12,550 ft. and gun perforated with 2,002 shots in the 1,300-ft. interval. The D-7 zone at Ventura Avenue is the deepest productive horizon developed to date. Earlier this year, the Lloyd Corp. completed well No. 18 on fee-owned acreage at 12,940 ft.

Standard of California's deep test in the Kettleman Middle Dome field staged a gas blowout of some intensity during the week

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P-68

while a mud change was being made. The well did not get away but kept the crew busy during an anxious 60-minute period as the job was complicated at the time by stuck drill pipe although partial circulation was possible. This deep test is down 10,920 ft. In the Belridge area, Belridge Oil Co. is still drilling ahead in search of the Wagonwheel sand.

At Gardena, Ohio Oil Co. is still testing its wildcat in that area but is only getting partial results due to packing failures and inability to set a formation tester. New locations were subnormal this week, falling well below completions. There has been little change in the scope of drilling during the past several weeks and a long-range view indicates a continuance at present levels provided, however, that material shortages are remedied in the immediate future.

Richfield Oil Corp. is abandoning its Portland, Ore., wildcat as unproductive at 7,885 ft. No favorable showings were found in this Multnomah County test, and no information has been released as to the formation in the bottom of the hole. Previously, California Standard had abandoned its Ferndale Community wildcat in Whatcom County, Washington, and The Texas Co. had abandoned its wildcat in Clatskanie County, Oregon.

CALIFORNIA WILDCAT FAILURES

Kern County: Commanche Point—Gilmour & Associates 2 Tejon, 25-32s-29e, bottomed in basement granite, top granite 1,260 ft., no oil sand found, TD 1,273 ft.

Dominion—Gene Reid Drilling 1 K.C.L., 15-26s-28e, bottomed in basement schist, top schist 1,019 ft., no showings, TD 1,185 ft.

Round Mountain—Miller & York, 13-28s-28e, bottomed in gray sand, top Vedder 2,384 ft., all sands barren, TD 2,400 ft.

Temblor—Beverly Trading 1 Anderson, 31-29s-21e, bottomed in gray sand, top Phacoides 1,827 ft., all sands barren, TD 1,944 ft.

Tejon—Tejon Oil 1-A Tejon, 19-11n-19w, bottomed in hard gray sand, unable to loosen DP, cut and recovered from 3,200 ft., TD 10,830 ft.

Orange County: Fairview—Tide Water Associated 1 Norris, 8-6s-10w, bottomed in hard gray sand, all sands gray and barren, TD 3,560 ft.

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CANADIAN FIELDS

East Extension of North Turner Valley Indicated

CHATHAM.—In North Turner Valley, Royalite-Lowery 7, LSD 5, 11-20-3w5, with Madison lime at 8,148-8,381 ft. showed 300 bbl. on early tests with partial acid treatment and booster gas.

Farther north, Foothills Oil & Gas 24, LSD 16, 4-21-3w5, an east side test, got the Madison high at 8,140 ft. Proving a rise in the lime to the east, this well indicates a possible extension of the producing area in that direction.

Kinsella.—In the Kinsella field east of Edmonton, Imperial-Kinsella 14, LSD 7, 28-45-9w4, finished at 2,048 ft., is testing a show of oil encountered with some gas in the Viking sand. Location is south of the drilling area, the oil show being the first in the extensive Imperial drilling. Two other Imperial wells are capped after testing, and two Northwestern Utilities wells are finishing.

Stolberg.—In the Central Alberta foothills, Imperial-Shell-Stolberg 1, deepest test drilling in western Canada, is below 12,375 ft. after getting the Madison lime at 12,218 ft.

Pinhorn.—In the Pinhorn area in southern Alberta, near the Montana boundary, McColl Frontenac-Union Oil 16D-29-1-9, LSD 16, 29-1-9w4 encountered sulfur water in the Madison lime at 3,236 ft. and has been abandoned. A third test in the 4-well program for this area is to be started.

Duvernay.—Testing a 200,000-acre reservation in the Alberta central plains area near Edmonton, Imperial-Duvernay 1, LSD 6, 30-55-11w4, has spudded and is below 2,000 ft. Location is about a mile southeast of Frontier-Brosseau 1, drilled in 1933, which got 6,500,000 cu. ft. gas at 1,330-40 ft. It is believed this development in a potential gas area is linked with the systematic Imperial development in the Kinsella gas field, as a basis for new projects in gas processing.

DeWinton.—In the DeWinton area, east of Turner Valley, Royalite-DeWinton 1, LSD 14, 16-21-1w5, contacted Madison lime at 8,331 ft. Coring into the top of the lime, a drill-stem test showed traces of gas with no water. Earlier, good gas and oil shows were encountered in the Dalhousie and Brown sands above the lime.

Jumping Pound.—On the Jumping Pound structure in the foothills west of Calgary, Shell 16-14-J, LSD 16, 14-25-5w5 is below 9,615 ft. with Madison lime expected around 10,000 ft. and completion likely at 10,300 ft. Location is midway between Shell 4-24-J, finished, in the Madison around 9,500 ft. with 13,000,000 cu. ft. gas and 95 bbl. initial light crude recovery, and Shell 10-14-J, abandoned in water in the Madison around 10,500 ft. The present test is based on the expectation that an important gas reservoir lies in the immediate vicinity of the discovery well.

Lloydminster.—In the Saskatchewan end of the Lloydminster field, Community Services-Regina 14, LSD 3, 11-40-28w3, got the oil sand at 1,869-74 ft. and is being placed on pump. Community 15, LSD 2, 11-49-28w3, finished at 1,880 ft. with sand at 1,865 ft. and has cemented. Community-Watrous 17, LSD 3, 11-49-28w3, with oil sand at 1,870 ft. is cemented. Withers-Groat 2, with oil sand

at 1,860-70 ft., is on the pump, and Withers-Groat 3, same LSD, with sand at 1,861 ft., is testing. Four other tests are drilling with one new location.

TEXAS GULF COAST

Gilbert Ranch Discovery Well Begins Production

HOUSTON. — Oil production has been opened by Sun Oil Co. 2 Gilbert Estate, wildcat test 8,370 ft. south and a little east of the 1 Gilbert Estate, discovery well for the gas and condensate production, Jefferson County, Gilbert Ranch field. The well cleaned through a 3/16-in. choke with 3,150 lb. flowing pressure and flowing 38°-gravity oil with 1 per cent water cut, through perforations at 8,737-42 ft. Total depth is 9,300 ft., and 5-in. liner is cemented on bottom.

Atlantic Refining Co. 1 J. R. Dempsey, wildcat test approximately 2,100 ft. southwest of 1 Houston-American discovery well for the South Hyatt field of Tyler County, in L. A. Beard survey, topped sands showing gas and condensate at 10,232 ft. and attempted to blow out of control while hole was being drilled at 10,244 ft. Flow was controlled.

Stanolind Oil & Gas Co. 1 Helen E. Hutlock, a 3,000-ft. extension test at Sugar Valley field, Matagorda County, in the Freeman Pettus Survey, has been completed as the best oil producer for the field. On potential test flowed 172 bbl. of 30°-gravity oil in 24 hours through a ⅛-in. choke with 1,700 lb. pressure on the casing and 1,100 lb. flowing pressure on the tubing with a gas-oil ratio of 530 to 1. Production is through 90 perforations at 8,980-95 ft. Total depth is 9,598 ft. and 7-in. casing was set at 9,064 ft.

Tide Water Associated Oil Co. 2 D. L. Underwood, wildcat extension test ½ mile southeast of 1 Underwood well at Sublime field in Colorado County, is flowing approximately 140 bbl. of 33°-gravity oil daily through a 3/16-in. choke. Production is through 42 perforations at 9,507-14 ft. Total depth is 9,580 ft. and 5½-in. casing is cemented to the bottom.

Gulf Oil Corp. 2 C. S. Settegast et al, deep wildcat test on the west flank of the Pierce Junction dome in Harris County, has recovered the core barrel lost while taking sidewall cores at 10,249 ft., and has drilled ahead to a present depth in salt at 10,408 ft. This test is in the Joseph Kopman Survey, Abstract 85.

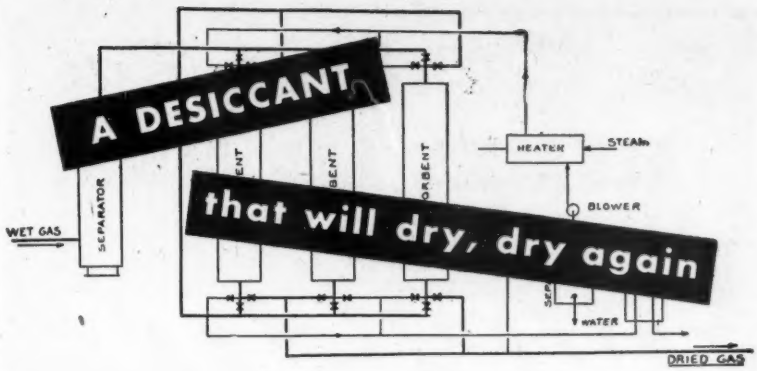
West Production Co. & Noranda Oil Co. 1 H. M. Boring, wildcat test southwest of Madisonville in Madison County, Amy Boatright Survey, has been killed and muddied up after bleeding the gas which had a maximum pressure of 4,500 lb. The test had attempted to blow out when pulling the testing tool through perforations at 11,815-865 ft. Tool is still in the hole.

Dick Schwab 1 O. H. Caldwell, potential discovery well 3 miles south of production in the Fairbanks field, Harris County, in the A. G. Holland Survey, has been plugged after showing for only small gas production through perforations at 8,302-20 ft. On an initial test through perforations 7,900-85 ft. the well flowed gas-condensate and salt water. Total depth is 8,475 ft., and 5½-in. casing was cemented at 8,343 ft. for the tests.

There were 16 new locations reported this week, four being wildcats, two in Jackson County and one each in Chambers and Fort Bend counties. Only four of the 14 completions were producers. The 10 dry holes included seven wildcats—three in Harris County, two in Montgomery County, and one each in Fort Bend and Jefferson counties.

UPPER GULF COAST TEXAS WILDCAT FAILURES

Fort Bend County: Gray Wolfe Co. et al 1 G. J. Lee, Wm. Pettus Sur., on south side of Juliff prospect, dry, TD 7,516 ft.



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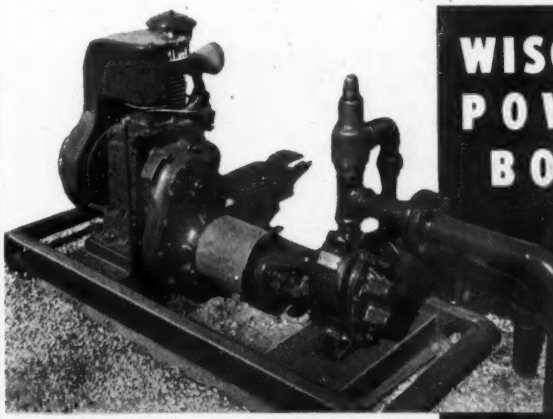

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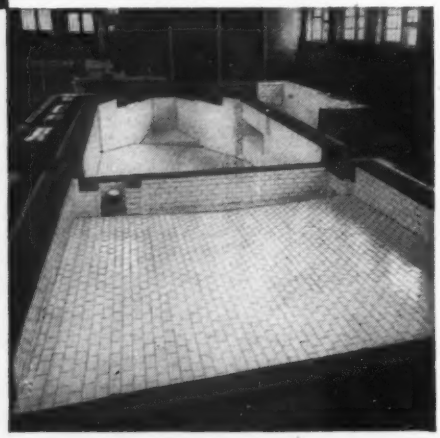

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Harris County: Allaun & Richardson 1 F. Dopslauf, WC RR Sur. Blk. 2, Sec. 22, 3½ mi. N of Barker, dry, TD 8,014 ft.
Harris County: Dick Schwab 1 O. H. Caldwell, A. G. Holland Sur., 2 mi. E of Fairbanks Townsite, dry, TD 8,475 ft.
Harris County: W. J. Goldston 1 H. J. Longenbaugh, Geo. Ayers Sur., 2½ mi. W. of Cypress Townsite, dry, TD 7,118 ft.
Jefferson County: A. H. & C. L. Rowan 1 Beaumont Bldg. & Loan, C. Wms. Sur., 3 mi. W Beaumont, dry, TD 8,725 ft.
Montgomery County: Ashland Oil & Refining, 1 Eliz. Gunter et al, Neil Martin Sur., 15 mi. NW Conroe, dry, TD 4,020 ft.
Montgomery County: E. H. Stafford 1 Fraser-Campbell, J. M. de la Garza Sur., Sec. 32, 7 mi. NE Willis, dry, TD 5,038 ft.

MICHIGAN

Results Poor From Week's Completions in Michigan

SAGINAW.—Michigan oil and gas operators listed 22 new locations while recording 19 completions for the week. Results were poor, including three small oil producers; one classed as a wildcat; and seven gas producers. All but one were in the Austin "storage pool." Of nine dry holes, three were wildcat tests.

Michigan Oil and Gas Association reported daily production shows additional increase, the April average of 47,828 bbl. being 1,700 bbl. better than for the previous month.

The new locations: five in Van Buren County; four in Clare County; three in Arenac and Montcalm counties; one in Gladwin, Kent, Mecosta, Muskegon, and Ottawa counties. Drilling permits for the year total 290.

MICHIGAN SUCCESSFUL WILDCATS

Allegan County: Allegan Twp.—R. E. Bradley 1 LeVette, Sec. 23-2n-13w; pumped 18 bbl., and salt water, after acid; TD 1,462 ft., in Traverse limestone.
Ogemaw County: Churchill Twp.—Sun Oil 1 Blum, Sec. 12-22n-3e; gas well, 134,000 cu. ft.; TD 1,546 ft., plugged back to 1,450 ft.

MICHIGAN WILDCAT FAILURES

Allegan County: Cheshire Twp.—Stanley F. Findley 1 Peter & Joseph Kaylor, Sec. 2-1n-14w; dry in Traverse limestone; TD 1,388 ft.
Otsego Twp.—Superior Oil 1 F. & G. M. Shafer, Sec. 35-1n-12; dry in Traverse limestone; TD 1,392 ft.
Newaygo County: Barton Twp. — Ashby Drilling 1 James W. LaVallee, Sec. 33-16n-11w; dry in Michigan stray; TD 1,233 ft.

EASTERN TEXAS

Outpost in Whelan Field To Test Rodessa Zone

DALLAS.—Rogers Lacy 1 Peal, S. N. Hall Survey, 1-mile northwest outpost to the Whelan field of western Harrison County and 1 mile northwest of Harleton, set casing at approximately 7,400 ft. to test the Rodessa pay section, which was the discovery pay zone. The Texas Co. 1 White, William King Survey, wildcat 4 miles west of Fairfield, Freestone County, was closed at 8,300 ft., shut-in for orders. The Travis Peak sand was apparently found barren.

Another failure for the LaRue Rodessa pool of northern Henderson County, 3 miles north of Athens, is the Lone Star Produc-

ing Co. 1 Faulk and Wofford, B. C. Walters Survey. It was swabbing salt water through casing perforations from 8,241-46 ft. This apparently was the Rodessa section of the discovery well, but was considerably low to the discovery. The test was carried to 8,886 ft. in the Pettit.

United North & South Development Co. have made a tentative location for a 7,200-ft. wildcat to the Edwards lime on a 320-acre Hooper tract in the Robert Copeland Survey, Abstract 107, 1½ miles west of Easterly in Robertson County.

Hawkins field, Wood County, had six completions this week, and Carthage field, Panola County, had two. Hawkins field had two locations, and Carthage field had one. Carthage field has 32 drilling wells; Hawkins field, 15; New Hope field, Franklin County, and Sand Flat field, Smith County, each six; and Opelika field, Henderson County, and Henderson field, Rusk County, each three.

EAST TEXAS SUCCESSFUL WILDCAT

Bowie County: New distillate pool—Barnsdall et al 1 Pickering, R. E. Sevey Sur., 4 mi. SW Texarkana, elev. 299 ft., flowed 59 bbl. 68° gravity distillate with 3,000,000 cu. ft. gas through 20/64-in. choke on tubing, perf. 7,030-85 ft. Smackover, gas-oil ratio 63,000 to 1, TD 7,503 ft.

SOUTH LOUISIANA

Oretta Field Test Gages 130 Bbl. at 8,745-58 Ft.

NEW ORLEANS.—At Oretta field in Beauregard Parish, Magnolia Petroleum Co. 1 Logan et al, 32-6s-11w, has been completed for an initial gage of 130 bbl. of oil through 66 perforations at 8,745-58 ft. using 7/64-in. choke, gas-oil ratio, 2,027 to 1. Total depth is 9,300 ft., and 5½-in. casing is cemented to 8,872 ft.

Humble Oil & Refining Co. 72 Orleans Levee Board, on the Potash dome of Plaquemines Parish, 13-18s-15e, flowed an initial test of 195 bbl. of 29°-gravity oil in 24 hours through a 9/64-in. choke with 750 lb. flowing pressure. Gas-oil ratio was 653 to 1. Test was through 30 perforations at 8,356-62 ft. Operators are still testing. On a previous test through 120 perforations at 8,310-35 ft., well flowed at the rate of 227 bbl. of oil daily through a ⅛-in. choke with 1,310 lb. flowing pressure on the tubing and a gas-oil ratio of 480 to 1, gravity, 28° corrected.

Sohio Petroleum Co. 1-A W. L. Trimble, wildcat test in the China field area of Jefferson Davis Parish, center SE NW 2-8s-4w, is preparing to make an initial try for production after some delay in conducting squeeze jobs. Pipe is being perforated from 9,174-80 ft. for test. Total depth is 9,598 ft., and 5-in. liner is cemented to the bottom.

Humble 1 W. R. Buffington, wildcat test in the Lettsworth area of Point Coupee Parish, 84-1s-7e, is drilling below 11,193 ft. in sand and shale on a scheduled 12,000-ft. venture. No shows of importance have been encountered to date.

Atlantic Refg. Co. 1-C State in Lake Pontchartrain, on State Lease 318, has been plugged after flowing salt water while drilling at a total depth of 10,927 ft. This is one of three deep tests the company is drilling in Lake Pontchartrain. The 1-B State on State lease 318; Edge Lake area, continues to drill below 8,120 ft. after setting 9⅝-in. protection casing to 7,880 ft. Also on lease 318, off shore in the lake from St. Tammany Parish, the 1-A State, set 9⅝-in. protection at 7,781 ft. and continues below 8,000 ft. All tests had originally planned to go 12,000 ft.

Only one wildcat location was made this week while 13 field tests were reported. The wildcat is in Terrebonne Parish in the Lapeyrouse area. Eight of the nine completions reported this week were oil producers, the one dry hole being a wildcat in Jefferson Parish. Acadia Parish reported two producers.

SOUTH LOUISIANA WILDCAT FAILURES

Jefferson Parish: Atlantic Refg. 1-C State-Lake Pontchartrain, State Lease 318, Twp. 12s-10e, dry, TD 10,927 ft.

N. CENTRAL TEXAS

New Wilbarger County Pool Opened Near Vernon

WICHITA FALLS.—A new pool has been opened in Wilbarger County by the National Associated Co. 1 Schmoker, Section 11, Block 14, H&TC Survey, 6 miles southeast of Vernon. The well was drilled to 7,518 ft. in the Ellenburger, topped at 5,693 ft.

On a drill-stem test from 5,696-5,718 ft. in the Ellenburger, the well showed 3,100 ft. of salt water. It was then plugged back for completion in the Canyon, topped at 3,510 ft. Operator set 6⅝-in. casing at 3,502 ft. and drilled out to 3,527 ft. The hole was cleaned out with water. The well flowed 170 bbl. of oil with some water in 8 hours while 2-in. tubing was being run. It has been shut in for storage and official gage.

Standard Oil Co. of Texas 2 Ward, J. M. C. Paxton Survey, assured an extension for the Morris sand of the Sivell's Bend pool of northern Cooke County. It flowed 287.51 bbl. of 41.6°-gravity oil in 6 hours through a ½-in. choke for one of the largest wells from this zone in the pool. Production is through 370 perforations from 6,662-6,889 ft. Sun Oil Co. 1 Gibson, John Massingill Survey, Abstract 687, has opened a new pay for the Sivell's Bend pool. On a drill-stem test from 7,368-78 ft., the well showed gas in 9 minutes. When tool was pulled after being open for 10 minutes 2,680 ft. of oil and 120 ft. of mud was recovered. This well missed the Rasure and Beasley zones of the pool and picked up the pay at a shallower depth than the 7,500-ft. horizon in the area.

Electra field, Wichita and Wilbarger counties, had six completions this week; Gatewood field, Cooke County, four; Wilson field, Cooke County, three; and Nocona field, Montague County, two. Gatewood field had three locations, and Electra field, two. National field, Wilbarger County, has nine drilling wells; Wilson field, eleven; Sivell's Bend field, Cooke County, six; and Hildreth field, Montague County, four.

In West Central Texas, Jones County Regular field and Stephens County Regular field each had three completions, and Shackelford County Regular field had two. Jones County Regular and Shackelford County Regular fields each had two locations. Cisco field, Eastland County, has five drilling wells; Reddin field, four; Silver Valley field, Coleman County, Palo

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NORTH CENTRAL TEXAS WILDCAT FAILURES

Archer County: Benson Bros. 1 Mrs. J. H. Turbeville, Blk. 149, R. Carson Survey, 7½ mi. W and 4 mi. N Archer City, dry, TD 1,500 ft.

D. L. Wolfe 1 G. E. Campbell, Blk. 87, J. W. Harris Subd., 3½ mi. S and 5 mi. W Archer City, dry, TD 1,330 ft.

Clay County: W. H. Hammon 1 Raymond Wood, Sec. 43, HT&B Sur. A-224, 1½ mi. S and 2½ mi. W Dean, elev. 988 ft., dry, TD 6,128 ft.

Wichita County: D. H. Bolin 1 Arnold Holzen, Lewis Powell Sur., 6 mi. W and 1 mi. N Burkburnett, dry, TD 2,021 ft.

Fortex Oil Corp. 1 Katie Weibner, BBB&C Sur. A-28, 4½ mi. E and 3½ mi. S Burkburnett, dry, TD 1,387 ft.

Norwood et al 1 Ed Payton, Blk. 319, Waggoner Colony lds., 5 mi. E and 6 mi. N Electra, dry, TD 2,053 ft.

WEST CENTRAL TEXAS SUCCESSFUL WILDCAT

Stephens County: New oil pool—Fred Manning, Inc., 1 C. J. O'Conner, Sec. 52, Blk. 7, T&P Sur., 8 mi. S Eolian, flowed 528 bbl. day through 18/64-in. choke, perf. 3,384-98 ft. Caddo, gravity 45.6°, gas-oil ratio 665 to 1, TD 3,403 ft.

WEST CENTRAL TEXAS WILDCAT FAILURES

Jones County: Bailey Balkan 1 Leon Horn, Subd. 100, DeWitt CSL, ¾ mi. SW Stith, elev. 1,807 ft., dry in Gunsight, TD 2,745 ft.

Ramsey Cox & Ben Hill 1 R. L. Hines, Sec. 21, Blk. 4, H&TC Sur., ¼ mi. N Avoca, elev. 1,535 ft., dry, TD 1,966 ft.

Shackelford County: H. V. Scholl 1-A Merrick Davis, Sec. 23, Blk. 12, T&P Sur., 7½ mi. SE Budmathews, elev. 1,738 ft., dry, TD 1,444 ft.

Taylor County: Hedrick & Jones & Stasney 1 Mrs. L. Hunter, Sec. 18, Blk. 9, SPRR Sur., 3¼ mi. SW Blair, elev. 2,018 ft., dry in Cisco, TD 3,120 ft.

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ILLINOIS

Three Illinois Wildcats May Open New Fields

MATTOON.—Wildcats in three counties of the Illinois basin were showing as prospective oil producers at the close of the past week. In Clay County the T. Blake Dirickson 1 Howell, SE SW SW 9-2n-7e, is now on a production test of the Aux Vases sand at 2,959-70 ft., total depth 3,205 ft. Following a 25-qt. shot, the well pumped 196 bbl. of oil in 24 hours. It is approximately 1 mile northwest of production in the West Clay City pool.

The L. A. Schumacher-Ben J. Taylor 1 Andrew Lamezyk, NE NE NE 12-3s-2w, Washington County wildcat, is setting pipe on the Benoist sand at 1,416-31 ft., total depth 1,431 ft. A 2-hour drill-stem test at 1,407-26 ft. recovered 20 ft. of oil and 65 ft. of oil-cut mud with no water. The 1 Lamezyk is approximately 1 mile north of production in the West Dubois field.

A Cumberland County test about 12 miles west of the old York field, Central Pipe Line et al 1 Myers, SE NW SW 36-9n-9e, has set pipe on the Rosiclare at 2,648-64 ft., total depth 2,776 ft., following recovery of 30 ft. of oil and 35 ft. of oil-cut mud on a 1-hour drill-stem test at 2,648-57 ft. No water has been indicated in tests so far. This well is a rank wildcat and appears to be located in line with a trend of fields established by Clay City, Boyleston, and Dundas fields. Successful completion as a producer would indicate an extension of this trend and might lead to important discoveries in the interval between the well and the North Boos field. The 1 Myers is about 26 miles southeast of the Mattoon field of Coles County.

Illinois completions remained at a low level during the past week with only 31 wells, 19 oil producers and 12 dry holes, reported. Six wildcat tests were finaled but all were unsuccessful. A total of 47 new operations were announced, including 5 wildcats, 1 each for Coles, Edwards, Hamilton, Shelby, and Clinton counties.

ILLINOIS WILDCAT FAILURES

Fayette County: J. R. Benson 1 G. Durre, SW SE NE 1-5n-4e, dry at 2,500 ft., Kincaid 1,622 ft., Menard 1,792 ft., Tar Springs sand 1,942 ft., Glen Dean 1,991 ft., Barlow 2,151 ft., Benoist 2,308 ft., Renault 2,362 ft., Aux Vases sand 2,374 ft., Rosiclare 2,447 ft., McClosky 2,460 ft.

Hamilton County: Magnolia 1 Boyle, NE SW SE 7-5s-5e, dry at 2,401 ft., Menard 2,430 ft., Waltersburg 2,496 ft., Vienna 2,554 ft., Tar Springs sand 2,572 ft., Glen Dean 2,639 ft., Hardinsburg sand 2,760 ft., Barlow 2,901 ft., Cypress sand 2,920 ft., Paint Creek 3,046 ft., Benoist sand 3,097 ft., Aux Vases sand 3,205 ft., Ste. Genevieve 3,270 ft., Rosiclare 3,286 ft., McClosky 3,350 ft., St. Louis 3,374 ft.

Abbott & Pond 1 McGee, SW NW NW 3-7s-5e, dry at 3,456 ft., Levias 3,306 ft., Fredonia 3,385 ft., McClosky 3,386 ft., St. Louis 3,443 ft.

Randolph County: C. R. Larson 1 S. Wilge, NE NW NW 2-7s-6w, dry at 738 ft., Paint Creek 596 ft., Benoist 684 ft., Aux Vases sand 718 ft.

Richland County: C. E. Brehm 1 Tellford et al, NW NW NW 11-3n-10e, dry at 3,257 ft., Menard 2,346 ft., Vienna 2,461 ft., Tar Springs sand 2,486 ft., Glen Dean 2,577 ft., Barlow 2,739 ft., Cypress sand 2,800 ft., Benoist 3,000 ft., Renault 3,060

ft., Aux Vases sand 3,078 ft., Ste. Genevieve 3,123 ft., McClosky 3,178 ft.

Washington County: Papoose Oil 1 Seibert, NE NW NE 19-2s-1w, dry at 1,575 ft., Menard 1,006 ft., Vienna 1,067 ft., Tar Springs 1,085 ft., Glen Dean 1,168 ft., Golconda 1,250 ft., Barlow 1,341 ft., Cypress sand 1,402 ft., Paint Creek 1,459 ft.

ROCKY MOUNTAIN

Badger Basin Field Gets Record Oil Producer

DENVER.—The Badger Basin field, Park County, Wyoming, which in the 15 years of its existence has hung up several records, scored again this week with what probably is the largest Frontier sand producer, outside of a few early-day "gushers" in Salt Creek, ever completed in the state. Resolute Oil Co. 8 Northern Pacific, C NE SE 7-57n-101w, came in flowing 950 bbl. of 48° gravity crude through a choke in 11 hours. It was then shut in. The structure is in the Big Horn Basin, and the completion again emphasizes the vast possibilities of the basinward domes which recently have been in the limelight.

The well was drilled to 8,476 ft. The 7-in. was cemented on top of the Frontier at 8,122 ft. after drilling a good saturated sand section at 8,425-75 ft. The tubing was being run to circulate when it kicked off and flowed 700 bbl. in 9 hours. The flow was steadily increasing and at the end of 11 hours it had put 950 bbl. of clean pipeline oil into the tanks. The casing pressure was 1,200 psi., tubing pressure 1,600 psi., and shut-in pressure 2,000 psi. The field lies 10 miles southwest of Elk Basin, where the Frontier is picked up at around 1,400 ft.

Madison wells in Cut Bank.—Prospects for developing substantial production in the Madison lime in Cut Bank over a considerable area have been enhanced by the recompletion of Carter Oil Co. 1 Larmon, C SE NE 12-36n-6w, after deepening 11 ft. and acidizing. This well, a south offset to the Brindley discovery, was completed at 3,073 ft., 67 ft. in the lime, for 11 bbl. of oil and 200,000 cu. ft. of gas. Following the completion of Union Oil Co. 1 Stufft, 2½ miles to the south, for 200 bbl. per day natural after acidizing, Carter went back into 1 Larmon and deepened it from 3,073 to 3,094 ft., acidized it with 1,000 gal. The well came in flowing 239 bbl. of oil in 23 hours through a ¾-in. choke after recovering the bad oil used in treating the well. The gas-oil ratio was 524, casing pressure 265 psi. and tubing pressure 100 psi. Carter has gone back into 1 Merchants Trust, east offset to the Brindley well and will deepen it and acidize. The porous saturated lime in the Larmon well was found approximately the same depth below the top of the Madison as in the Union well and encourages the belief that a consistent producing horizon has been discovered in that formation. Conditions are apparently different from those found in Kevin-Sunburst where the production is found at the contact between the Ellis and the Madison, with occasional production in breaks in the lime below the top. The erratic porosity in the top of the Madison at Kevin-Sunburst is credited to pre-Jurassic weathering of the limestone surface.

Rangely development speeded. — More rapid development of the Rangely field in Colorado is scheduled for this year. California Co., which now has 15 rotary rigs running, is moving in 5 more, and Texas Co., with 8 rigs running, will bring in 5 additional rotaries. On June 1 there were 71 wells completed and 44 were drilling. Thirteen wells are scheduled for completion in June, and the total by July 1 will be up to 84. Present schedules indicate between 100 and 110 wells by September 1. Following completion of Utah Oil Refining Co. compressor station at Baggs, Wyo., increasing the capacity of the line into Utah, runs have jumped to 26,150 bbl. per day. This is close to capacity and it is apparent that more pipe-line transportation will have to be provided or daily take from wells reduced below 300 bbl. per well.

Cat Creek tests.—Last October a new producing horizon in the Ellis formation was discovered on the Mosby dome of the Cat Creek field in Garfield-Petroleum counties, Montana, in Dave Schrock 1 Fifer, NW NW NW 21-15n-30e, the well averaging 300 bbl. per day. Some good producers have been completed south and southeast of this dis-

NEW 1945-1946
PETROLEUM REGISTER

The PETROLEUM REGISTER, national and international oil directory, recently issued its 24th Annual Edition, a complete revised record of all branches of the industry with detailed data on Producers, Drilling Contractors, Refiners, Pipe Lines, Marketers and Jobbers, Natural Gasoline Mfrs., etc.

Recent advertisements of the MIDWEST OIL REGISTER in oil journals has caused confusion among many in the industry, who, noting the similarity in names, believe it to be connected in some way with the PETROLEUM REGISTER.

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covery, one making 1,350 bbl. initial, with dry holes interspersed around them. Continental Oil Co. explored the area to the northwest drilling six wells, of which five were producers and the sixth, ½ mile northwest of the discovery, resulting in a dry hole. Interest then turned to the west dome where most of the 25,000,000 bbl. produced in the field originated. Ralph Chamberlin 12-A Rhens, NE NE SE 9-15-29e, an old well, was deepened to 1,753 ft., and was classed as a possible discovery with estimate of 50 bbl. per day, but it still is testing. Continental is drilling an east offset in 11 Harlan, SW SW NW 10-15-29e. At 1,738 ft., in the Morrison, from which the offset was reported producing, a drill-stem test at 1,725-38 ft., open 40 minutes, had a recovery of 250 ft. of drilling mud, no oil, water or gas. Likewise, on the east dome, Hanlon-British-Dominions Oil Co. 2 Government, NE SE SW 6-14-31e, was reported to have swabbed 150 bbl. of oil in 24 hours at 1,827 ft. Texas Co. 1 Northern Pacific, C NE SE 35-15-30, 2 miles northwest of the Hanlon well, has been completed at 2,200 ft. as a dry hole. It had the top of the Fifer sand at 1,832 ft. and in a drill-stem test at 1,832-35 ft., recovered 3 ft. of fine (wet) sand and no shows. It ran 25 ft. lower than the Hanlon well and was plugged.

New operations.—Twenty-three new operations were reported, of which 2 were in Colorado, 5 in Wyoming, 15 in Montana, and 1 in northwest New Mexico. Four were wildcats, the remainder development wells. Colorado locations were two in the Rangely field by California Co. Wyoming locations included one each in Oregon Basin, Little Buffalo Basin and Spence, and two wildcats. The latter are W. G. Dunn 1 Nefsy SW SW SW 5-41n-60w, Clifton district, Weston County, and Dyer & Rice 1 Otis Barber, NW SE 3-33n-76w, Big Muddy field. Last named is located a mile east of the nearest Lakota sand well and a mile west of the eastern edge of the Wall Creek pool. It will test the Dakota-Lakota sands at 4,500 ft. Montana locations include five in Cut Bank, three in Kevin-Sunburst, two in Cat Creek, two in the Hardin gas field, and one each in the Bowdoin and Cedar Creek gas fields. One wildcat location is MacKinnie Oil & Drilling Co. 1 Douglas, C NW NW 3-1s-34e, Nine Mile structure, Big Horn County, to go to the Dakota at 2,200 ft. Location follows the drilling of four shallow wells to the top of the Frontier to determine closure, the deepest being 1,042 ft. The New Mexico location is Paul B. English and Byrd-Frost, Inc. 1 Federal, C NW SW 4-27n-10w, Kutz Canyon district, San Juan County, a Dakota test to 7,500 ft.

Completions.—Fourteen wells were completed, of which 9 were oil wells with initial production of 2,404 bbl., 2 were gas wells and 3 were dry holes. These were distributed one in Colorado, in the Rangely field; six in Wyoming, one each in Badger Basin, South Elk Basin, Lance Creek, Oregon Basin, and Zimmerman Butte. Montana had seven completions, of which two were oil wells with 40 bbl. initial, two were gas wells and three were dry holes.

MONTANA WILDCAT FAILURES

Cat Creek, Garfield-Petroleum counties: Texas Co. 1 Northern Pacific C NE SE 35-15n-30e, TD 2,200 ft., Fifer sand 1,832 ft., no shows, plugged.

East Teton River, Teton County: General Petroleum 38-3-G, SW SE SW 3-25n-8w, TD 3,129 ft., ran into fault at 1,565 ft., top of Eagle 1,956 ft., unable to recover cir. in fractured formation, plugged.

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OKLAHOMA

Second Oil Pool Looms For East Antioch Structure

CITIES SERVICE OIL CO. has apparently discovered its second oil pool in the East Antioch area of Garvin County with the 1-B Wallace, a wildcat in NW NW SW 18-3n-1w. The 1 Wallace topped the Bromide section about 130 ft. higher at 5,130 ft. than the 1 Abernathy, 13-3n-2w, discovery well of the area. The Wallace was drilled and cored to 5,327 ft. and a drill-stem test at 5,314-27 ft. recovered gas in 2 minutes estimated at approximately 1,500,000 cu. ft. daily. Oil started in 8 minutes and the well flowed for 11 minutes at the rate of 30 to 35 bbl. per hour. Oil was tested at 36.5° gravity.

The well will be drilled deeper into the sand before running pipe to test. Since the Bromide was so much higher in the 1 Wallace than in the 1 Abernathy, many oil men believe that the two wells are on separate subsurface structures and thus two oil pools.

Champlin Refining Co. has opened a new pay horizon in the old Cruce area of Stephens County with its 1 Creel, NE SE NE 30-1n-5w, and has applied to the state corporation commission for a 150-bbl. per day allowable. The 1 Creel was an old producer at about 2,000 ft. After depletion, it was deepened to 2,595 ft. and pipe was set in sand and perforations made at 2,508-75 ft. The well then tested 459 bbl. of oil in 12 hours through a ½-in. choke.

Latest reports available indicate that Tom Berry et al have made a shallow strike in Pottawatomie County at their 1 Johnson, NW NW SW 27-6n-3e, a semi-wildcat in the West Archer area. The 1 Johnson picked up a sand at 1,855 ft. and a drill-stem test of the section showed 1,600 ft. of oil-cut mud and 30 ft. of clean oil in 30 minutes. An electric log was being run.

OKLAHOMA SUCCESSFUL WILDCAT COMPLETION

Cimarron County: Bridwell Oil Co. 1 Houghton, SE NW NW 23-3s-11w, pumped 27 bbl. oil a day from sand at 1,490-1,500 ft., TD., 35.7° gravity.

OHIO, KENTUCKY

Blue Rock Pool Extended Southeast by New Well

COLUMBUS.—The Blue Rock pool was extended 1 mile southeast by a 5,499,000 cu. ft. well, Industrial Gas 1 Lester Gillogly, Section 11, Blue Rock Township, Muskingum County.

The gage was taken after blowing open 8 hours, and the well after being shut in 24 hours, showed 1,250 lb. Clinton sand was topped at 4,387 ft. and was drilled to 4,432 ft. The same company extended the Salt Creek pool 2 miles to the northeast with a small Medina sand producer, E. F. Clapper, Section 14, Salt Creek Township, Muskingum County.

G. B. Harmon 1 E. C. Hanenstein, Section 9, Jackson Township, Ashland County, was drilled through the second Clinton, 2,917-2,926' ft., and shot and shut-in at 3,060,000 cu. ft.

Frank Lyons 1 Thomas Arse, Section 26, Jackson Township, Ashland County, found Clinton sand at 2,944-96 ft. and gaged 375,000 cu. ft. with a good show of oil. Well was shot and is now flowing oil.

Ashland field reported three locations, Brush Creek, Cambridge, Sandyville, and Stewart reported two each. Cambridge field led in completions with six of the 21 total.

OHIO SUCCESSFUL WILDCATS

Muskingum County: Salt Creek Twp.—Industrial Gas 1 E. F. Clapper, Sec. 14, Clinton 4,270-85 ft., dry, Medina 4,380-4,388 ft., 18 bbl., TD 4,388 ft.

EASTERN KENTUCKY

ASHLAND.—Kentucky-West Virginia Gas Co. brought in the only gas well completion in the Eastern Kentucky area during the past week.

The completion was well No. 5635 on the R. C. Stafford property in Martin County. Total depth was 606 ft., and daily open flow 146,000 cu. ft. of gas in Salt sand.

Two oil well completions were noted. J. P. Perry completed well No. 4 on the Ike Brown property in Powell County, total depth 822 ft., estimated daily production 2 bbl.

R. B. Fannin completed well No. 4 on the R. B. Fannin property in Elliott County, total depth 886 ft., estimated daily production 5 bbl.

WESTERN KENTUCKY

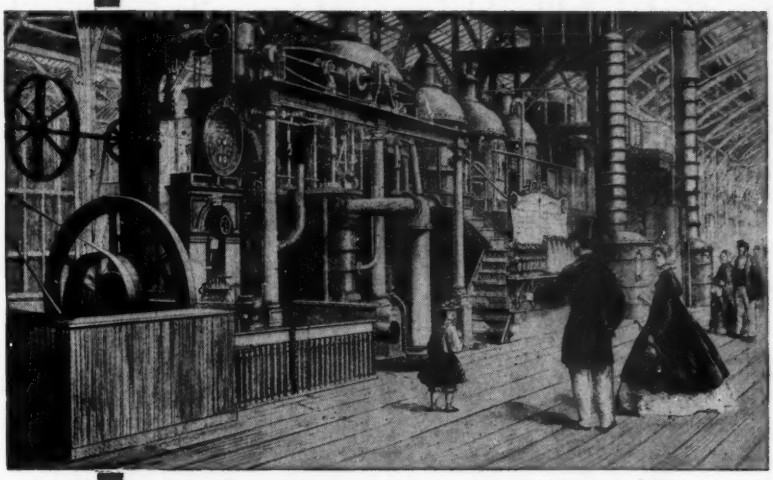
OWENSBORO.—Location has been announced for a deep wildcat test in Lincoln County by the California Co. The test is the 1 Spears, 13-L-57, north of the present oil play in Wayne and Clinton counties. It is scheduled to go to the granite, which is expected at about 9,000 ft.

Other new tests announced during the week totaled five and were located in Union, Daviess, Crittenden and Henderson counties. Completions for the week included five oil wells and one dry hole. No wildcat completions were reported.

INDIANA

EVANSVILLE.—No completions were reported in Indiana during the past week, although new operations showed an upward trend with 15 tests announced. They were located as follows: eight in Gibson, three in Pike, three in Posey, and one in Spencer County.

Continental's deep test in the Griffin pool, the 1-D Cooper Estate, SW SW 13-3s-14w, has resumed operations and is drilling ahead at 4,369 ft. The Carter Oil Co. 1 John Larkin, SE NE SW 17-6s-14w, Posey County prospect, is waiting on cement with 7-in. casing set at 2,788 ft. on the Aux Vases sand at 2,791-2,803 ft. No other wildcats are at important stages of development.



Famous Facts

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Arkansas Wildcat to Test Sand Section

SHREVEPORT.—C. A. Kinard's wildcat 6 miles east and 3 miles north of Monticello, in Drew County, Arkansas, was showing for a possible pool opener last week after finding showings of gas and oil in a sand near the 4,000-ft. level. Total depth of the well is 5,057 ft. Operators ran casing to bottom of the sand at 4,105 ft. to perforate and test a 200-ft. section. Description of the well is C NE SW 14-12s-6w.

Last reports on other Arkansas wildcat activity were: Placid Oil Co.'s 1 Levi West, NW SE NE 19-14s-21w, drilling below 3,800 ft. Location is 2 miles west of the town of Willisville in Nevada County.

One mile southeast of Ogden, in Little River County, R. W. O'Meare et al, of Shreveport, staked the 1 Ed Wood heirs in Section 7-14s-28w. Operators were moving in rig and materials on last report.

KANSAS

New Oil Pool in Prospect For Western Kansas

A NEW pool for western Kansas is indicated by the Mazda Oil Co. 1 Henderson, E½ SE NE 22-11-18w, Ellis County. Plug was set when the Arbuckle lime showed oil staining and saturation at 3,633 ft. When the plug was drilled out and the well deepened from 3,634-37 ft., the hole began to fill up with oil and a 1,600-ft. fillup occurred in 3 hours. Preliminary estimates are for a 500 to 1,500 bbl. well after acidizing. The 1 Henderson is approximately 2 miles west of the Barnett pool and about the same distance from the Richards pool.

The Isern Brothers 3 Southern, SE SW NE 14-19-10w, has been designated as the discovery well of a new pay horizon in the Doran West pool of Rice County by the Kansas Corporation Commission. It is producing from the Kansas City lime while formerly all production has been from the Arbuckle. The W. J. Page et al 1 Hagg, NW SE SW 32-14-2w, has also been designated as a new pay zone discovery, opening Viola production in the Salina pool.

A new oil pool is in prospect for Trego County, where the Republic Natural Gas Co. 1 Hille, SE SE SW 23-15-24w, swabbed oil at the rate of 39 bbl. in 6 hours. Production is from the Mississippian at a total depth of 4,316 ft. Top of the Mississippian was called at 4,293 ft. The well was treated with 7,000 gal. of acid and pumping equipment is now being installed. The 1 Hille is a rank wildcat in the southwestern part of the county with the nearest production 9 miles to the southwest in the Arnold pool of Ness County.

Also indicating a new oil pool at the close of the week was the Keys Drilling Co. et al 1 Dwyer, SW SW 1-19-18w, Rush County. Top of the Lansing was, marked at 3,311 ft. and Arbuckle at 3,625 ft. Total depth is 3,632 ft. with good saturation and porosity logged in a 7-ft. section of the Arbuckle. Pipe has been set and preparations are under way to begin testing. The 1 Dwyer is 2 miles west and 1 mile north of the West Merten pool on a farmout from Stanolind Oil & Gas Co. It is being supported by the Sinclair Prairie Oil Co.

KANSAS WILDCAT FAILURES

Barton County: Biddle Drlg. et al 1 Fsern, NE NE NW 19-19-11w, dry at 3,418 ft., Arbuckle 3,391 ft.

Butler County: Rex & Morris 1 Perkins,

SW SW SW 27-25-4e, dry at 2,590 ft., Viola 2,589 ft.

Ellis County: Veeder Supply Co. 1 Richards, SW SW SE 8-11-18w, dry at 3,609 ft., Arbuckle 3,580 ft.

Ness County: Gulf Oil Corp. et al 1 Bowser, SE SE SE 7-19-23w, dry at 4,770 ft., Arbuckle 4,770 ft.

Reno County: H. A. Hershfield 1 Thompson, W½ NW NE 20-24-10w, dry at 4,101 ft., Arbuckle 4,068 ft.

Rice County: B & R Drlg. Co. 1 Adams, NE NE NW 22-18-7w, dry at 3,463 ft., Viola 3,332 ft.

Rush County: Sohio et al 1 Mendenhall, SE SE SE 3-18-19, dry at 3,970 ft., Arbuckle 3,929 ft.

Sumner County: Fidelity Royalty 1 Hewzel, NE NE NW 14-35-1e, dry at 3,752 ft., Wilcox 3,742 ft.

LA.-ARK.

Cranfield Pool Well Drilling Ahead in Chalk

JACKSON.—Humble Oil & Refining Co.'s 1 Adams City Board of Supervisors, in Section 47-6n-1w, south of the Cranfield field in Adams County, was drilling below 9,705 ft. in chalk at last report. Other Mississippi wildcat reports indicate considerable drilling in progress but no definite shows of oil were logged. Southwest of Humble's well, Ohio Oil Co. had completed roads and was moving in material at its 1 George W. Armstrong in 12-5n-3w. In Clarke County, Sun Oil Co. 2 Long Bell Petroleum Co., 17-2n-17e, was drilling below 2,900 ft. In Forrest County, Superior Oil Co.'s 1 Cassie Bradford, 1-3n-13w, was said to be drilling below 8,300 ft. Top of chalk was reported at 5,817 ft.

In Walker County, Alabama, Glen D. Rose Oil Co. 2 First National Bank of Birmingham, C W½ NW SE 30-12s-7w, was drilling below 1,800 ft. Showings of gas were found in the Tuscumbia at 1,240 ft. and 1,788 ft., with oil shows reported at 1,445-50 ft., and 1,455-65 ft. in the base of the Hartselle.

CALENDAR OF EVENTS

June

Federal Power Commission hearing in the natural-gas industry investigation, Washington, June 17.

Canadian Gas Asscciation, thirty-ninth annual convention, Murray Bay, Que., June 17-19.

Western Petroleum Refiners Association. second postwar regional technical meeting, Olds Hotel, Lansing, Mich., June 20.

Southern California Meter Association, Annual Low Jinks and June meeting, Rio Hondo Country Club, Downey, Calif., June 20.

Houston Nomads, Old College Inn, Houston, June 24.

American Society for Testing Materials annual meeting, Buffalo, June 24-28.

American Petroleum Institute, board of directors, Adolphus Hotel, Dallas, Tex., June 25.

Pennsylvania Grade Crude Oil Association, twenty-third annual meeting, William Penn Hotel, Pittsburgh, June 27-28.

July

Los Angeles Nomads, annual meeting and party, Mayfair Hotel. July 10.

Houston Nomads, Old College Inn, Houston, July 29.

August

Interstate Oil Compact Commission, quarterly meeting, August 8-10, Grand Rapids, Mich.

Houston Nomads, Old College Inn, Houston, August 26.

American Institute of Chemical Engineers, western convention, Palace Hotel, San Francisco, August 25-28.

September

Sixth annual Appalachian Gas Measurement Short Course, West Virginia University, Morgantown, W. Va., September 9-11.

American Chemical Society, semiannual meeting, Chicago, September 9 to 13.

Pacific Coast Gas Association, annual convention, Fairmont Hotel, San Francisco, September 10-12.

Fourth National Chemical Exposition, sponsored by Chicago section, American Chemical Society, Coliseum, Chicago, September 10-14.

Los Angeles Nomads, Mayfair Hotel, September 11.

National instrument conference, sponsored by Instrument Society of America, William Penn Hotel, Pittsburgh, September 16-20.

National Petroleum Association, forty-fourth annual meeting, Hotel Traymore, Atlantic City, N. J., September 18-20.

Houston Nomads, Old College Inn, Houston, September 30.

October

American Association of Oilwell Drilling Contractors, sixth annual meeting, Plaza Hotel, San Antonio, Tex., October 1-2.

American Institute of Mining and Metallurigal Engineers, Petroleum Division, annual meeting, Galvez Hotel, Galveston, Tex., October 3-5.

American Gas Association, annual meeting, Atlantic City, October 7-12.

Los Angeles Nomads, Mayfair Hotel, October 9.

Texas Mid-Continent Oil and Gas Association, Rice Hotel, Houston, October 16-18.

American Institute of Mining and Metallurical Engineers, Petroleum Division, annual meeting, Ambassador Hotel, Los Angeles, October 24-25.

Houston Nomads, Old College Inn, Houston, October 28.

Independent Petroleum Association of America, annual meeting, Fort Worth, October 28-30.

November

Society of Automotive Engineers, national fuels and lubricants meeting, Mayo Hotel, Tulsa, November 7-8.

A.P.I. annual meeting, Stevens Hotel, Chicago, November 11-14.

Los Angeles Nomads, Mayfair Hotel, November 13.

Houston Nomads, Old College Inn, Houston, November 25.

December

American Society of Mechanical Engineers, New York, December 2-6.

Los Angeles Nomads, Mayfair Hotel, December 11.

Houston Nomads, Old College Inn, Houston, December 30.

1947

January

Society of Automotive Engineers, annual meeting and engineering display, Book-Cadillac Hotel, Detroit, January 6-10.

Kentucky Producers Blast Price Control

(Continued from page 80)

erator as a total of 10 jobs in 1941 with a success frequency of 50 per cent. In the 1944-45 period, however, the same operator performed 64 jobs with a success frequency of 97 per cent.

Use of wall-cleaning guides was described, and the record reported that of 200 multiple-sand jobs where wall-cleaning guides were used, only five wells subsequently required squeeze cementing. Other parts of Rogers' report dealt with mud control, vertical moving of pipe, and controlled cement slurry qualities. Electric-log curves were shown to be useful as a tool for the selection of proper location of wall-cleaning guides on casing strings, specific well by specific well.

In his paper on Kentucky gas reserves, Jones predicted many new gas fields will be discovered in the state, some of which will be comparable or even better than the new Dixie pool of Henderson County. However, he warned, the state does not present a bright picture for either the gas utility or the nonutility producer.

Reserves Decline Alarming

"The declining reserves in the Appalachian field as a whole is alarming," he said. "This is reflected in Kentucky, and as we face the problem of developing new reserves we must realize the largest undeveloped shale gas area is to the west and southwest of the present field . . .

"The most hopeful possibility for Kentucky lies in the development of the Big Six sand. Gas from this horizon may furnish much of the peak load gas while reserves of shale gas are being developed.

"It is generally agreed that the remaining new reserves will be developed by the hearty cooperation of the gas utility and nonutility producers. Throughout the history of the gas industry, in many cases, it has been the small producer or group of individuals who has moved out into the marginal areas or in between dry holes in an effort to develop new production.

"Gas, unlike oil, must be produced before the gathering system has been removed from that particular area, otherwise small discoveries will be left without a market. Therefore, it is important to encourage development within reach of the gathering systems." Finally, our present proved and potential areas no doubt will develop sufficient reserves to assure market demands for at least 20 years. If deeper horizons already indexed prove productive our reserves will be correspondingly greater."

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LUBRICATOR DIVISION

Among the

Drilling Contractors

Regent Drilling Co. of Vermilion, Alta., is drilling an exploratory test, in LSD 13, 28-22-12w4, in the Wardlow district of southern Alberta for British American Oil Co. and Standard Oil Co. of California. Regent also has contract for four salt wells for Canadian Industries, Ltd., at Windsor, Ont., of which two have been completed.

Howard Bensil Shields Drilling Co. has been contracted to drill the Stoll Oil Refining Co. 2 Howard McCauley in SW NE 10-6s-5e, Harrison County, Indiana.

J. W. Carter Drilling Co. is drilling ahead at 1,000 ft. at the Sun Oil Co. 1 C. A. Sutton, northwest of the farm in 19-O-22, Henderson County, Kentucky.

Archie Newland Drilling Co. has spudded the Redfield Oil & Gas Group 1 Charles Macklin in NE 17-78n-28w, Dallas County, Iowa.

Premier Drilling Co. completed the 1 Schultz for the Crown Oil, Inc., in NE NE NE 8-19s-15w, Barton County, Kansas.

Harbar Drilling Co. holds contract on the Ed Swearer 1 Deal, in NE NE SW 25-18s-37w, Wichita County, Kansas. The test will be drilled on a 17-section block.

R. H. Dearing & Sons, drilling contractor of Dallas, has staked location for the 1 Gibson, in NE NE NE 15-4n-2w, about a mile northeast of the Maysville townsite, Garvin County, Oklahoma. The test will go to the Wilcox.

Loffland Brothers are drilling contractors on the California Co. 1 Spears, 13-L-57, Lincoln County, Kentucky, near McKinney, and were moving in materials for a test to the granite.

Crow Drilling Co. was rigging up at the Gulf Refining Co. 1 I. H. Bass, in SE NW SW 8-1n-16w, Lamar County, Mississippi.

Crawford Drilling Co. was rigging up at the Gulf Refining Co. 2 W. J. Howard in Section 17-1n-16w, Lamar County, Mississippi.

Patrick & Tyrrell Drilling Co. was rigging up on the Gulf Refining Co. 1 Maggie L. Thompson, in SE NE SW 14-9n-19w, Jeff Davis County, Mississippi.

Grey & Wolfe, Houston, have been awarded contract to drill La Gloria Corp. et al 1 Mrs. L. J. Lipps, about 2½ miles south of Rachal, in Brooks County, Texas, and are moving in on the location. This is an 8,500-ft. wildcat test in El Perdido grant.

Makin Drilling Co., Hobbs, N. M., now has two rigs drilling for Penrose Oil Co., Inc., and one for Skelly Oil Co., all in Lea County, New Mexico.

Moran & Moran hold the drilling contract on the Dave Bennett and J. W. Sorrels 1 F. S. Sanders, in Section 186, Washington CSL Survey, Tom Green County, Texas, and was moving in material for an 8,000-ft. rotary test. Location is 11 miles northwest of San Angelo.

Hutchings Drilling Co. is rigging up at the Midstates Oil Corp. 1 Lightsey unit in NE NW 19-1n-13e, Heidelberg field, Jasper County, Mississippi.

G. H. Vaughn Drilling Co. is moving in rig at the Blackwell Oil & Gas Co. 2 A. P. Milner in NW SE 22-23n-8w, Claiborne Parish, Louisiana.

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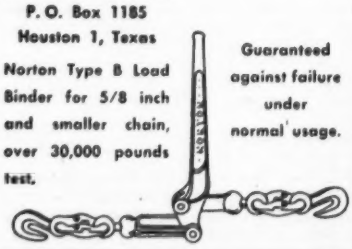

Guaranteed against failure under normal usage.

Newman Brothers. San Antonio, will drill The Texas Co. 1 Catarina Farms Co., 3½ miles northwest of Catarina, in Dimmit County, Texas, to a depth of 6,000 ft. Location is in Ellen Hart Survey, in Lot 1, Section 70, Catarina Farms subdivision.

Crow Drilling Co. is the contractor at the Carter Oil Co. 1 Rex Alman unit in SW SE NE 4-10n-3w, Choctaw County, Alabama.

Crow Drilling Co., Shreveport, has been awarded drilling contract on the Rudd & Madtingly 1 W. F. Spencer, in C NE NW 26-8n-20e, Pike County, Alabama. Cellar and pits have been completed for the test, which is 6 miles southeast of Goshen.

Crain Drilling Co. has the drilling contract on the Sun Oil Co. 3 W. R. Hammett, in Section 15-11n-1e, in the Bruinsburg field, Claiborne County, Mississippi, and was rigging up rotary to deepen the test from 1,052 ft.

World Mineral Conference To Hear Fraser, Krug

NEW YORK.—Sir William Fraser, chairman of Anglo-Iranian Oil Co., Ltd., and Secretary of the Interior Julius A. Krug are among the speakers scheduled to address the World Conference on Mineral Resources to be held at the Waldorf Astoria, September 16-18.

Delegates from every mineral-producing country in the world have been invited to attend, according to Louis S. Cates, president of the American Institute of Mining and Metallurgical Engineers.

Carter Group Awarded

Special awards for research on secret wartime devices, including the proximity fuse, were received from the Navy last week by Carter Oil Co. and by 60 of its employes. In addition to those who received the Naval emblem, Naval ordnance development award certificates were presented to Dr. A. B. Bryan, H. F. Moses, Dr. P. S. Williams, R. W. Gemmer, F. G. Boucher, Ben W. Sewell, Dr. E. M. McNatt, Dr. Norman Ricker, R. S. Dahlberg, Jr., V. A. Acheson, C. C. Nash, Jr., R. H. Blood, and P. H. Foster.

LEGAL

Notice is hereby given that on Wednesday, June 19, 1946, at 2:00 P.M. in the Knotty Pine Room in the basement of the Farmers & Bankers Life Building, Wichita, Kansas, there will be sold at public action to the highest bidder for cash, oil and gas royalty interests and reservations consisting of 3262 royalty acres participating and 1860 royalty acres non-participating. These are located in Barber, Ellis, Gove, Logan, Rooks, Sherman, Thomas, Trego and Wallace Counties, Kansas.

Bids will be received on the various tracts separately and all of said tracts collectively. Sale will be made either in individual tracts or collectively, whichever way the bids are the highest.

Complete information showing the description number of royalty acres in each tract, the date of expiration of royalty interests and whether participating or not will be mailed upon request to the undersigned address.

If unable to attend this sale, you may submit sealed bids either on the individual tracts or collectively. All sealed bids must be accompanied by certified check or bank draft payable to the undersigned for at least ten per cent of the amount of the bid, balance to be paid upon notice of acceptance of bids and delivery of proper conveyance by the undersigned.

All successful bidders at the auction will be required to deposit ten per cent of their bids and pay balance upon delivery to them of proper conveyance by the undersigned.

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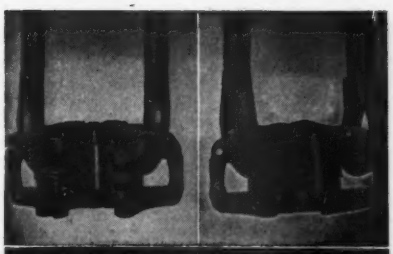

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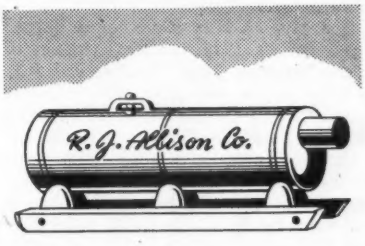

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PERSONALS

Administrative Job Taken by Keegan At Houston

AFTER more than a year's service in the New York office, Peter E. Keegan has returned to Shell Oil Co.'s Houston refinery in the capacity of administrative superintendent.

A native of Kansas, Keegan joined Shell Oil in 1929 as safety inspector at the Houston plant. Two years later, he was made manager of industrial relations, holding this position until his transfer to New York in 1944.

In New York, he was assistant manager of the company's personnel department. In his new position in Houston, he is in charge of personnel and industrial relations, office management, storehouses, and the tank car repair shop. Keegan is married and the father of five children.

Glen M. Ruby, vice president of United Engineering, S. A., left Punta Arenas, Chile, recently for a short trip to Alaska to attend a technical meeting at Fairbanks in connection with the development of Naval Petroleum Reserve No. 4. **Bart Gillespie** is project manager there for Hoover, Curtice & Ruby, Inc., the firm which holds the exploration and drilling contract. Ruby is also vice president of this firm.

O. H. Beshell has been transferred to Dallas as assistant division superintendent, central division, Magnolia Pipe Line Co. Other transfers in the company effective June 1 are: **P. F. Roten,** appointed district superintendent of the Midland district, Danville, Ind.; **M. E. Powell,** named assistant division superintendent, northern division, Oklahoma City; **L. J. White,** promoted to assistant district superintendent of the Dallas district with headquarters at Corsicana, and **Roland McDonald,** appointed assistant district superintendent of the Luling district at Vanderbilt, Tex.

Dr. Gonzalo Acosta, former oil inspector at El Centro, Colombia, has been transferred to the Ministry's Bogota office. **Dr. Gilberto Delgado,** petroleum engineer, has taken over Acosta's duties at El Centro.

Norman Hardy, president of Richmond Petroleum Co. of Colombia, is in Colombia on a field visit. Hardy is also president of the Richmond Petroleum Co. of California. **F. T. Plaza,** Richmond's special representative in Bogota, has returned to Colombia after a 5-month stay in the United States.

Mario A. Lavarello, refinery engineer for Yacimientos Petroliferos Fiscales, arrived in New York recently from Buenos Aires. He expects to spend several months in the United States studying new refinery processes. Lavarello joined Y.P.F. in 1925 and made his first trip to the United States in 1940.

R. E. Muller, New York, new president of Panhandle Producing & Refining Co., has been named to head four Panhandle subsidiaries. He will assume control of Panhandle Refining Co., Panhandle Steel Products Co., Petroleum Building Co., and Panhandle Drilling Co.

Robert S. Cooke, a meteorologist for 3 years in the Army and recently released as a first lieutenant, is now a petroleum engineer in the production department of Carter Oil Co. at Tulsa.

J. C. Lovelady has returned to Carter Oil Co. as a senior petroleum engineer with headquarters at Seminole, Okla. He was recently released to inactive duty from the Army Signal Corps.

H. A. Proctor has moved up from plant superintendent to administrative engineer of the butadiene plant of Southern California Gas Co. Other changes include **K. G. Steinbeck,** plant superintendent, who now is supervisor of all plant operations; **M. M. McMahon,** to staff engineer; and **R. W. Bailey,** to production control engineer.

H. W. HAIGHT

John L. Kalb, vice president and director of Creole Petroleum Corp., has resigned, and **Harold W. Haight,** Creole's production manager in Venezuela, has been named to fill the vacancy. Kalb, who has been with Standard Oil Co. (New Jersey) and its affiliates for more than 20 years, has accepted a new post with International Petroleum Co., Ltd. Haight has been with Jersey Standard and affiliates since 1927 and at one time was manager and chief geologist of Standard Oil Co. of Egypt.

Paul C. Billings, a member of the process control department at the Bayway and Bayonne, N. J., refineries of Standard Oil Co. of New Jersey, has been made a technical assistant in the paratone plant at Bayway.

Martin G. Miller and **Max R. Lents,** petroleum engineers and assistants to **J. R. Butler,** former general manager of Cotton Valley Operators Committee and Haynesville Operators Committee, have resigned their positions with the committees to remain assistants to Mr. Butler in his new capacity as vice president and general manager of newly formed Old Ocean Oil Co., Houston.

Sidney Lee, chemist and chemical engineer, formerly with the crude production research department of Atlantic Refining Co., Dallas, is now associated with Associated Laboratories in Dallas.

Eddie Deardurff has been made assistant maintenance foreman at Pure Oil Co.'s Heath, Ohio, refinery.

Bill Dulaney has been made general maintenance foreman of Pure Oil Co.'s

Cabin Creek, W. Va., refinery. Other changes there include **Harold Sanders,** to general operating foreman; **Howard Pyle,** to technical foreman, and **Charlie Hulbert** to assistant resident chemist.

H. R. Kunhardt, Caracas, president of Venezuelan Petroleum Co. and of Cia. Consolidada Petroleo, both Sinclair Oil Corp. subsidiaries, is in New York on a routine business trip, his first in a year.

E. E. Kinney has joined the engineering department of Pure Oil Co. after a service in the Seabees as a lieutenant. He is now supervising the installation of new gas lines from the Toledo refinery to Libby-Owens-Ford glass plant. News of other personnel in Pure's engineering department: **R. J. Bentson, Jr.,** and **J. E. Bauman** both returned to the company after Navy service, and **J. A. Falcone,** transferred from the Northfield laboratory.

B. W. Beebe, chief geologist for Bay Petroleum Corp., is being transferred effective June 15 from Wichita, Kans., to the company's general offices in Denver to take charge of an expanded exploration program. **E. L. Birmingham, Jr.,** Oklahoma district geologist, will take charge of the Wichita office, and **E. L. McCown,** formerly consulting geologist at Oklahoma City, will succeed Birmingham as Oklahoma district geologist with headquarters in the division office at Wichita.

A. F. Carter, former Navy rear admiral who retired last November from his wartime post as executive officer of the Army Navy Petroleum Board, has been named resident director in London of the newly-organized United Overseas Petroleum Co., Ltd. He will leave for London early in July. United Overseas was formed by Standard Oil Co. of California and The Texas Co. as a service corporation to handle affairs that relate to their joint foreign interests in England. Carter, a graduate of the Naval Academy at Annapolis, served in the regular Navy until after World War 1 and entered the oil business in 1925.

O. G. McClain, since 1943 chief geologist for Southern Minerals Corp., has resigned and opened a consulting geological office in Corpus Christi, Tex. McClain is associated with Crutchfield and Pruett, consulting petroleum engineers.

Norman D. FitzGerald, Abilene, Tex., independent operator, discussed "The Role of Economic Thinking in the Petroleum Business" at a recent meeting of the student chapter of the American Institute of Mining and Metallurgical Engineers of the University of Texas in Austin.

More than 40 oil men were guests last week at a dinner for members of the New Mexico Oil Scouts Association given by the oil activities committee of the Artesia, N. M., Chamber of Commerce. Above are members of the Oil Scouts Association and local civic leaders. Back row—Raymond Miller, N. M. Conservation Commission, Artesia; Gene Roberts, Jr., Hobbs, Drilling and Exploration Co., secretary of the Oil Scouts Association; W. C. Mitchell, Midland, Tex., Continental Oil Co., president of the association; Chuck Aston, consulting geologist, Artesia; Emery Carper, Carper Drilling Co., Artesia; A. P. Mahone, mayor of Artesia; and Artie McAnally, president of the Artesia Chamber of Commerce. Second row—Sam Brown, Western Gas Co., Jal; R. M. Knoepfel, Atlantic Refining Co., Carlsbad; Fred Tyner, Pure Oil Co., Roswell; Niven Baird, American Republics Corp., Artesia; T. A. Frazer, Phillips Petroleum Co., Midland; Ralph Hickman, Humble Oil & Refining, Midland; Al Bleakley, Stanolind Oil & Gas Co., Midland; Frank Stahl, U. S. Geological Survey, Artesia; Jerry Curtis, Magnolia Petroleum Co., Roswell; and W. H. Gray, Sun Oil Co., Roswell. Front row—R. L. Walker, Amerada Petroleum Co., Midland; George Carr, Richfield Oil Corp., Midland; Bill Wilson, Sinclair Oil Corp., Midland; Jim Walton, Superior Oil Co. of California, Midland; Jack Lively, Standard Oil Co. of Texas, Midland; W. M. Fitzgerald, American Trading & Production Co., Midland, and J. H. Burton, Cities Service Oil Co., Midland

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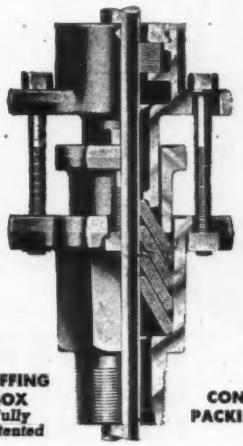

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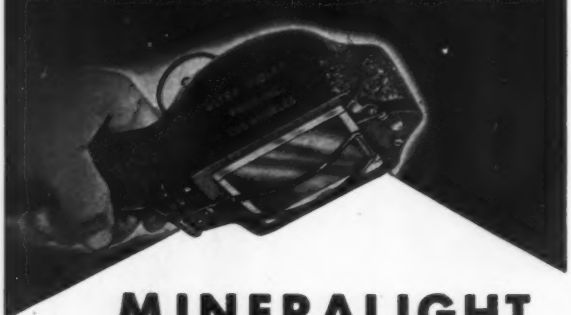

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Equipment Men in the News

Krause Retires From Lee C. Moore

C. R. KRAUSE

The voluntary retirement of Charles R. Krause as president of Lee C. Moore & Co., Inc., has been announced by Newton Chapin, Sr., chairman of the board.

Krause was associated with the company from April 1919 to May 31, 1946. In 1920 he came to Tulsa from Pittsburgh as western manager and 9 years later was elected president of the company with offices in Tulsa.

Newton Chapin, Sr., will assume the title and duties as president of the company with offices in Pittsburgh. As previously announced on March 1, Norman F. Rohrkaste was named executive vice president and H. J. Woolslayer named vice president and general manager.

Cooper-Bessemer Appoints New Tulsa Sales Engineer

The Cooper-Bessemer Corp. announces the appointment of Melvin S. Kenady as a member of its Tulsa sales engineering staff. Kenady has been connected with the company's Mount Vernon, Ohio, sales department staff.

Kelly Joins Mavor Co.

T. F. P. Kelly has joined James E. Mavor Co. of Houston, distributors of corrosion-preventio n materials and equipment. Kelly will handle sales on Bitumastic pipe-line coating, Carey pipe-line wrap, cathodic - protection units and related protection materials and equipment. He will cover the states of Texas and Louisiana.

Kerotest Acquires Security Valve

The Security Valve Division of Security Engineering Co., Inc., Whittier, Calif., a member of the Dresser Industries, Inc., has been acquired by Kerotest Manufacturing Co., Pittsburgh valve manufacturer, according to an announcement by Edward G. Mueller, Kerotest president.

A new manufacturing plant has been acquired at Slauson and Alcoa Avenues, Los Angeles, where the present line of Security cast and forged steel valves and Kerotest valves will be produced for Pacific Coast and western distribution.

At the same time, Mueller announced the formation of a new company—The Kerotest Pacific Co. (to be operated as a subsidiary of the parent Pittsburgh company, Kerotest Manufacturing Co.). The purchase included all of the present stocks, designs, good will, and equipment of the Security Valve Division.

Sales Representative Named

Synchro-Start Products, Inc., 1046 West Fullerton Avenue, Chicago, announces the appointment of Dallas Southwest Co. of Dallas as sales representative for the states of New Mexico, Texas, Oklahoma, Arkansas, Louisiana, Mississippi and western Tennessee. The activities of this company are directed by R. P. Waite of Dallas.

Houston Nomads Hear of Chile's First Oil Well

Houston chapter of Nomads met May 27 in the Varsity Room of Ye Olde College Inn. President Charles Thornhill presided over the meeting, which was attended by 54 members and guests. Guests included James H. McCabe, E. W. Saybolt & Co.; J. D. Rice, W-K-M Co.; M. B. Baylor, Gribben & Baylor; Paul Richmond, recently discharged from the Navy; J. S. McCune, Humble Oil & Refining Co.; H. C. Ross, Edwin Ross, and Lew Bronzan, Baash-Ross Tool Co.; R. P. Bovard, Merco-Nordstrom Valve Co.; and Stewart B. Beckley, Brown & Beckley. Sam Low, Houston attorney, was guest speaker. Low, who served during the war for 3 years in Santiago as a representative of the Board of Economic Warfare, spoke on Chile's first oil well and on other South American developments.

Rockwell Elected Director Of United Engineering

Col. W. F. Rockwell, board chairman and president of Rockwell Manufacturing Co., has been elected to the board of directors of United Engineering & Foundry Co., Pittsburgh.

Continental Opens Denver Office

The executive offices of Continental Supply Co., Dallas, have announced the opening of an office in Denver. This latest Continental sales point is located in the U. S. National Bank Building. George A. Stout is representative. J. R. Chapman, district manager at Casper, Wyo., will supervise the operation of the Denver office.

Lummus Names Public Relations Manager

C. S. Reed, president of the Lummus Co., designing and construction engineers, New York City, has announced that J. J. O'Donnell has been appointed personnel and labor relations manager. O'Donnell was formerly director of personnel for Bendix Aviation Corp. of New Jersey. He has also been associated with Home Owners Loan Corp. as regional personnel supervisor.

Appoint Export Representative

American Manufacturing Co. of Texas announces the appointment of E. F. Gahan, 500 Fifth Avenue, New York 18, to handle its line of pumping units, A.P.I. tool joints, and other equipment for export sales.

Stentz to Represent Kieley & Mueller

Stentz Equipment Co., Tulsa, completed arrangements to represent Kieley & Mueller, Inc., in the Tulsa area.

S. L. Stentz, president, was associated with the A. M. Byers Co. as sales engineer and later joined the organization of The National Tank Co. He left this company prior to the war, to help organize the Materials Division for the Petroleum Administrator for War and later was commissioned and assigned to the Air Transport Command.

The Stentz Equipment Co. has been organized to cover the specialty field in the oil industry. Kieley & Mueller pressure regulators, liquid level controls, diaphragm motor valves and allied products will become a major part of the organization's lines.

Failing Names European Representative

Announcement is made by G. P. Gregory, Jr., export manager for George E. Failing Supply Co., Enid, Okla., Houston, and Midland, Tex., of the appointment of O. V. Lindqvist as European sales representative. Lindqvist will establish his office in London, and will represent the Failing company both in Europe and in parts of Africa.

Officials of Lane-Wells Co. and The Texas Co. are shown standing near the gun poised over Texas Co.'s 11 W. S. Rhodes well in Conroe field, Texas, as Lane-Wells prepared to "shoot" its 75,000th well-perforation test. Pictured are John Wear, field foreman, W. C. Kneale, acting South Texas division production manager, and L. T. Tighe, superintendent of drilling, all of The Texas Co., and Morton T. Higgs, division manager of the Gulf Coast division, Lane-Wells Co.

HERCULES TOOL CO. MOVES INTO NEW BUILDING

S. P. Tschappat, president of Hercules Tool Co., has announced the change in location of that company to its new offices and plant at 1201 West Seventeenth Street, West Tulsa. The modern offices are of brick and tile, while the plant which joins the office building is of steel.

Don G. Rhoads, formerly of Continental Motors, has joined Hercules Tool Co. as engineer.

Project Engineering Co. Moves Design Office to New York

G. M. BARBOLINI

Project Engineering Co. has moved its main engineering design office to 15 Maiden Lane, New York City, and will continue to maintain the operation of its fabricating facilities at Long Island City.

The company operates as engineering contractors under the management of Guy M. Barbolini, Fitch B. Jefferies and James P. O'Donnell, who were formerly associated as engineers with The M. W. Kellogg Co. It is engaged in design, fabrication, erection, and operation of complete plants, especially in the chemical and petrochemical field. It specializes in units involving new processes and mechanical equipment design for special applications.

F. B. JEFFERIES

J. P. O'DONNELL

The company is concerned particularly with the problems of the small refiner and offers specialized engineering to them. Recently completed by the company is the design, erection and operation of a plant for a midwestern company. It is also placing in operation very shortly a second plant which applies the modern spray drying process to a chemical-plant application.

Wood Joins American Cyanamid

H. Stuart Wood has joined the petroleum chemicals department of American Cyanamid & Chemical Corp. after serving for 3 years in the U. S. Navy as a petroleum inspector in the New York and Rhode Island areas. Prior to his naval service, Wood was employed in the refineries of the Lago Oil & Transport Co., Aruba, N.W.I., and United Refining Co. of Warren, Pa.

Stewart & Stevenson Opens Three Offices

Stewart & Stevenson Services, Houston, recently opened branches in Corpus Christi, Dallas, and McAllen, Tex., it is announced by Joe Manning, general manager. Charles Ward is manager of the Dallas office, Dick Conolly is manager in Corpus Christi, and the service manager in McAllen is C. F. Beal.

Pittsburgh Steel Changes Advertising Personnel

J. K. Beeson, executive vice president, Pittsburgh Steel Co., announces the absorption of the sales promotion department by the sales department following the resignation of Elmer T. Wible, former manager of products promotion. Advertising authority is now vested in the vice president in charge of industrial and public relations, Garrett A. Connors. Lester W. Gaupp has been named office manager-advertising. Smith, Taylor & Jenkins, Inc., Pittsburgh, continues as advertising agency.

Carpenter District Sales Manager for A.C.F.

Announcement is made by American Car & Foundry Co. that E. B. Carpenter has been appointed district sales manager of the St. Louis office. He succeeds L. W. Martin who has retired.

Fairbanks, Morse Elects Secretary

Announcement has been made by Col. Robert H. Morse, president and general manager of Fairbanks, Morse & Co., that L. W. Stolte has been elected secretary of the company, to replace Fred C. Dierks, recently retired after a long service of 45 years.

Mr. Stolte joined the Fairbanks, Morse organization in 1928 as a bookkeeper in the Cleveland branch. In July 1945, he was transferred to the headquarters office of the company in Chicago as general credit manager, which position he now holds in addition to his duties as secretary.

Homco Opens Export Office

Houston Oil Field Material Co., Inc., announces the opening of an export office at 500 Fifth Avenue, New York. E. F. Gahan is export manager.

Firm Moves to New Building

Warner Lewis Co., Tulsa, has moved into its new building at 817 North Lewis Place. Facilities at the new plant consist of a large repair shop, stock room, repair and maintenance department, and display room.

Evans Succeeds Berry

Robert W. Duden, president, Petroleum Equipment, Inc., 307 South Boulder, Tulsa, announces the election of M. Stuart Evans to the office of vice president, and the resignation of W. C. Berry as an officer and director.

Security Appoints Jones Houston Division Manager

William C. "Casey" Jones, after 1½ years in the contracting business in Texas, has rejoined the sales staff of Security Engineering Co., Inc., as district manager of the Houston division with offices at 1053 Millie Esperson Building. Jones first joined Security's sales staff in 1939. After working California from both the Whittier and Bakersfield offices he was transferred to Texas where he covered the fields of South Texas, East Texas, and Louisiana.

Penetron Service Co. Formed

Announcement has been made of the formation of Penetron Service Co., with offices in Houston. The company is composed of Philip H. Lipstate, Jr., Leonard A. Kratzer, and Felix B. Gordan, all graduate petroleum engineers. The company expects to develop many field applications of the Penetron, which was described in the June 30, 1945, issue of The Oil and Gas Journal.

Ramsay Manager of National Radiator Division

DAVID M. RAMSAY

David M. Ramsay recently was appointed manager of the industrial division of National Radiator Co. of Johnstown, Pa., according to an announcement by Robert S. Waters, president. Ramsay has been with National Radiator for 5 years, having been a field engineer in the Boston office, assistant manager of the industrial division, and assistant to the manager of the heating division in charge of specialty sales.

At the recent opening of the Brewster plant in Shreveport, Reams Supply Co. of Alice, Tex., South Texas representative for The Brewster Co., took the enclosed twin-engined Cessna belonging to Alice Pipe & Supply Co., owned by Joe Gleason, and flew the pictured customers up to this new modern plant which has manufactured oil-well equipment for the last 20 years. There was a barbecue following the showing and introduction of the N-10 draw works which was sold to Crow Drilling Co. of Shreveport. Pictured are: Back row: Bill Watson, The Brewster Co.; D. L. Polk, Miller Bros. & Bowling Drilling Contractors; Harry McCartney, Alice Pipe & Supply Co.; Henry Reams, Reams Supply Co.; Hugh Graves, Production Service Co., Inc.; H. O. McElveen, Kirkwood & Morgan Drilling Contractors; L. D. Thomason, The Brewster Co.; R. L. Kirkwood, Kirkwood & Morgan Drilling Contractors; John D. Pedigo, Altex Well Service Co.; A. O. Graves, Commercial National Bank, Shreveport; A. Olin Price, The Brewster Co., and Gleason. Front row: Bob Sexton, Alamo Air Lines; Maxine Edmondson, Alice Pipe & Supply Co.; James P. Hill, Hill Air Service.